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A RADICAL OPERATION FOR EXCISION OF THE BIG TOE-NAIL

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The need for a simple and yet adequate technique for the surgical management of recurrent infected toe-nails is readily apparent. Surgery is indicated when other methods of prevention and control prove unavailing, such as proper shoes and stockings, cutting of the nail straight across, packing of the free edges with cotton-wool and the control of skin infections. An understanding of the anatomy of a nail and the pathology of the condition is essential for its proper management.

Anatomy

A nail consists of the following parts:

(*a*) The body or exposed part.
(*b*) The free border or distal extremity.
(*c*) The root or part implanted in a groove in the skin.
(*d*) The nail bed which consists of the germinal matrix proximally and the sterile matrix distally.

It must be stressed that, by proliferation of the cells of the germinal matrix, a nail grows in length only.

Pathology

The free border of the nail, as a result of external pressure (e.g. badly fitting shoes), traumatizes the adjacent skin. This lesion, complicated by low-grade sepsis, results in a small chronic ulcer. The edge of the ulcer overlaps the nail, giving the appearance of the nail growing into the soft tissues, or ingrowing toe-nail as it is incorrectly termed.

Management

All patients suffering from this condition should be examined for the presence of vascular, diabetic or neurological disorder, and if either is present appropriate measures should be instituted. It is seen that treatment directed at the 'ingrowing' part of the nail is unsatisfactory. Hence such operations as avulsion of the nail, the wedge resection operation, and even the terminal amputation (hemiphalangectomy), are unsatisfactory.

Fig. 1. Bilateral-hemiphalangectomy.

Fig. 2. Result of operation described.

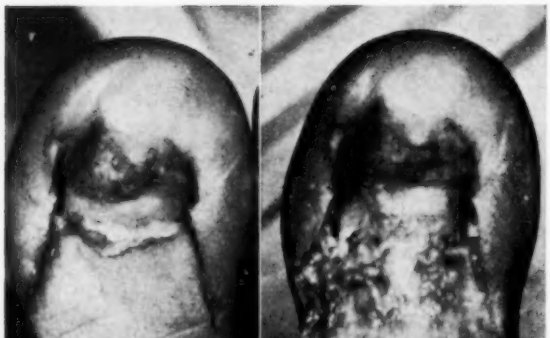

Fig. 3. and 4. Stages of operation described.

The last-mentioned operation, besides shortening and deforming the toe (Fig. 1, right), does not ensure freedom from recurrence of the condition (Fig. 1, left). The correct treatment is aimed at excising the germinal matrix. By the technique described below, this can be achieved without in any way shortening or deforming the toe (Fig. 2).

Procedure

Under general anaesthesia a tourniquet is applied and the nail is avulsed. The skin is cleansed and prepared with antiseptic solution. One-inch incisions are made from either side of the base of the nail, extending proximally and to either side of the toe (Fig. 3). The area of skin and subcutaneous tissue between the incisions is reflected proximally and held in position with two skin hooks. A large block of tissue (germinal matrix) is excised, extending from just distal to the distal interphalangeal joint to a point opposite the nail fold, and extending well laterally. (Fig. 4). This is excised down to bone, care being taken to remove every remnant of the nail bed. The skin flap is replaced and sutured in position with nylon sutures on either side. A pressure bandage is applied.

The patient is allowed to bear weight on the 3rd postoperative day.

SUMMARY

The anatomy and pathology of the chronic infected toe-nail is discussed. A simple radical operation for its treatment by excision is described.

COLLEGE OF PHYSICIANS AND SURGEONS OF SOUTH AFRICA

History of the Formation. The College of Physicians and Surgeons of South Africa has been in the process of formation for a considerable time. The Constitution has been under consideration for over 4 years, but it was only at the Inaugural Meeting held in Johannesburg in May last year, that certain decisions were taken to finalize the Constitution. The Constitution has now been approved by the Registrar of Companies and the Minister of Economic Affairs and the College is registered as a non-profit-making company in South Africa.

Membership. The original intention to distinguish Founder and Foundation Fellows and Founder and Foundation Members was abandoned at the Inaugural Meeting, and all those who had joined the College before May 1954 are to be denominated Founders, and all those who shall, within the stipulated period, join the College after its incorporation as a company are to be denominated Associate Founders.

Associate Founders. It was agreed that Associate Founders should be eligible for admission for 180 days following the incorporation of the College. The College was incorporated on 21 July 1955 and therefore Associate Founders are eligible for admission to membership of the College until 17 January, 1956, both dates inclusive.

Fees for Admission. It was decided that the fee for admission of an Associate Founder to the College of Physicians and Surgeons should be £31 10s. (30 guineas). This will entitle the Associate Founders to the privileges of Founders, except that at elections of the Council of the College not more than 3 of the 12 elected may be Associate Founders.

Management of the College. It has been agreed that until the election of the first Council, which will take place after 17 January 1956, the management of the College shall be in the hands of the Steering Committee which was appointed at the Inaugural Meeting. Immediate decisions will be taken by the Executive, to be appointed from amongst members of the Steering Committee.

Purpose of the College. The College as envisaged has several functions to perform. Its responsibilities to the profession are largely of an academic nature, and it is hoped that eventually it will provide facilities not yet available in South Africa—that it will sponsor and carry out examinations of a post-graduate nature in the specialties, enabling South African graduates to obtain recognition for post-graduate work without having to proceed overseas. It will also stimulate and arrange post-graduate teaching and eventually provide facilities such as are provided by the colleges in Great Britain, Canada, Australia and America.

Why you should Join. Membership of the College is open to every registered medical practitioner in the Union of South Africa until 17 January 1956. While what the College apparently has to offer is not tangible in the sense of immediate reward, it gives an opportunity for every practitioner to take part in a movement which will help to broaden and improve the standard of practice in this country. By joining the College you will be helping to lay down something for posterity and giving something to the future of South African medicine and, while your reward will not be immediate, you will have the satisfaction of knowing that you have contributed and materially helped those practitioners in South Africa who shall come after us. By being an Associate Founder you will have the privilege of nominating, electing or standing for election to the Council of the College. All those interested in joining the College as Associate Founders should apply to the Secretary of the College of Physicians and Surgeons of South Africa, P.O. Box 120, Cape Town, when application forms and copies of the Constitution will be sent.

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EDITORIAL

MODERN INSULIN THERAPY IN DIABETES

With so many different types of insulin at present available it is opportune to survey the field and weigh up the possibilities and advantages of each starter. Ordinary, unmodified, soluble insulin arrived first, thanks to Banting, Best and their forerunners. On subcutaneous or intramuscular injection its action begins within ½ hour, is at its maximum between 2 and 4 hours, and has usually ceased in 6-8 hours. The larger the dose, however, the more delayed is its maximum activity and the more prolonged its effect. This phenomenon is common to all the insulins. Occasionally a single moderate dose of soluble insulin appears to control a diabetic patient throughout the whole 24 hours, presumably owing to slowness of absorption. Occasionally an injection of soluble insulin night and morning is still preferable for continued control to any long-acting variety, but this is also unusual.

Soluble insulin is essentially the insulin for emergencies. It is the only insulin which should ever be employed in diabetic ketosis or coma. In such a case, where it is quite certain that the coma is not hypoglycaemic, then the first attending doctor at the first possible moment should inject the patient with 100 units of insulin if comatose or semicomatose, or with 50 units if merely drowsy. In these circumstances 100 units of insulin given early may be worth 1,000 units given late, after the patient has been taken to hospital. The reason for this lies in the ketotic vicious circle. Ketosis induces insulin-resistance (possibly through adrenal cortical stimulation and gluco-corticoid production), and insulin-resistance allows deterioration of the diabetic state, which increases ketosis. In the treatment of diabetic coma it is common practice to inject all the insulin intravenously. Insulin injected into a systemic vein, however, may be very rapidly destroyed and so, failing to produce the desired effect, may lead the doctor into given ever-increasing doses. It does act more quickly by this route, as is seen in the insulin-tolerance test, when a fall in blood sugar occurs within 10 minutes. Actually the immediate effect of most intravenously-injected insulin (not the Danish preparation) is a rise in blood sugar caused by the extremely rapid action of the impurity, glucagon. This effect is probably of no importance in cases of coma,

VAN DIE REDAKSIE

MODERNE INSULIENBEHANDELING BY DIABETES

Daar is vandag soveel verskillende soorte insulien beskikbaar dat dit nou 'n goeie geleentheid is om hierdie terrein in oorsig te neem en die voordele en moontlike waarde van elke nuwe soort te oorweeg. Die gewone, onveranderde, oplosbare insulien het, danksy Banting, Best en hul voorlopers, die eerste sy verskyning gemaak. Dit word onderhuids of in die spiere ingespuit en begin binne 'n halfuur werk. Dit bereik 'n hoogtepunt tussen 2 en 4 uur, en is gewoonlik uitgedien na 6 of 8 uur. Hoe groter die dosis, hoe meer vertraag is die hoogtepunt en hoe langer die duur van die uitwerking. Hierdie verskynsel is 'n eienskap van alle soorte insulien. Soms skyn dit dat 'n enkele, matige dosis van oplosbare insulien 'n suikersiektelyer oor die hele 24 uur beheer, waarskynlik weens die feit dat dit so stadig in die liggaam opgeneem word. Soms, hoewel selde, is 'n inspuiting van oplosbare insulien soggens en saans tog verkieslik bó behandeling met enige van die lankwerkende soorte.

Oplosbare insulien is eintlik die soort wat veral by noodgevalle gebruik moet word. Dit is die enigste soort insulien wat ooit vir diabetiese ketose of koma gebruik moet word. In so 'n geval, waar dit vasgestel is dat die koma nie deur bloedsuikergebrek veroorsaak was nie, moet die eerste behandelende geneesheer so gou moontlik 'n inspuiting van 100 eenhede insulien toedien as die pasiënt bewusteloos of halfbewusteloos is, of 50 eenhede as hy maar net lomerig is. Onder hierdie omstandighede kan 100 eenhede wat vroeg genoeg gegee word meer beteken as 1,000 wat laat, eers nadat die pasiënt in die hospitaal is, ingespuit word. Die rede hiervoor is die noodlottige kringloop van ketose. Ketose werk 'n insulienweerstand in die hand (miskien deur bynierskorsprikkeling en glukose-kortikoïed-produksie); die weerstand vererger die kondisie van suikersiekte, wat dan op sy beurt 'n groter mate van ketose veroorsaak. Gewoonlik word diabetiese koma behandel met aarinspuitings van al die insulien wat toegedien moet word. As insulien egter in 'n sistemiese aar ingespuit word, mag dit baie gou vernietig word, en as die inspuiting dan nie die gewenste uitwerking het nie, mag dit die geneesheer steeds groter dosisse laat toedien. 'n Inspuiting het wel 'n vinniger uitwerking as dit langs hierdie roete gegee word, soos bewys kan word uit toetse vir insulienweerstand waar die bloedsuikerhoogte binne 10 minute al afneem. Die onmiddellike gevolg van die meeste aarinspuitings van insulien (behalwe die Deense preparaat) is 'n werklikheid 'n styging in die bloedsuikerhoogte wat veroorsaak word deur die uiters vinnige werking van die onsuiwer stof, glukagoon. By die meeste komagevalle

and the best practice may be to inject 50% of the insulin intravenously and the other 50% intramuscularly at several different sites. (Absorption from subcutaneous injection may be very slow in patients in deep shock.)

Other emergency uses for soluble insulin are found in preparation for, and in the period immediately following, a major operation in a diabetic. It is certainly easier in general to use soluble insulin exclusively at these times, since any errors in judgment are so easily corrected by sugar on the one hand or by more insulin on the other. A trap for the unwary here lies in the fact that a largish dose of long-acting insulin given the day before the operation may still be acting and may even lead to hypoglycaemia in a fasting subject. A diabetic suffering from severe acute intercurrent infection is also more easily and safely controlled on soluble insulin. On the one hand the infection tends towards insulin-resistance and ketosis, while the relative anorexia of the patient tends to produce hypoglycaemia. A complete alteration in diabetic status is to be expected with consequent alteration in insulin requirements. In fact, when any patient is in hospital for control of his diabetes it is preferable to start with soluble insulin, since it can be given 3 or 4 times a day and the dose rapidly stepped up until approximately the total required is reached, when a switch may be made to a longer-acting variety.

Other insulins have come and gone, but the next one to stay was zinc protamine insulin (ZPI), a variety which acts up to 36 or even 48 hours. Its unnecessarily prolonged effect, the danger of nocturnal hypoglycaemia, and the poor control it affords during the day, render the advisability of its continued use problematical. Certainly no new patient should be started with it now. There are still some cases, however, who were well-controlled with a ZPI-soluble mixture and whom one is loath to change. The writer knows one man who has been for several years excellently controlled on a mixture of ZPI and soluble, 100 units of each, injected separately. A difficulty in mixing these two insulins in the same syringe lies in the excess zinc in the ZPI preparation, which converts a variable proportion of the soluble insulin into more ZPI. Because of this, (1) more soluble than ZPI should be used in any mixture, (2) the soluble should always be drawn up first into the syringe, and (3) the doctor never knows just what he is giving. Zinc protamine insulin is still of use in patients who will only take their insulin every other day or even twice a week, and is apparently of considerable value in diabetic dogs and also in experimental animals.

Globin insulin in theory has an action midway between soluble and ZPI, but in practice it has proved generally unreliable and there really seems little point in bringing it to the starting gate at all. NPH (a protamine, non-zinc-containing, insulin from Hagedorn's laboratory) is

is hierdie uitwerking waarskynlik nie belangrik nie, en dit is miskien wenslik om 50 persent van die insulien binneaars en die ander 50 persent in die spiere in te spuit, op verskillende plekke. (By erg-geskokte pasiënte mag absorpsie van 'n onderhuidse inspuiting baie stadig wees.)

Oplosbare insulien word ook as noodmiddel gebruik onder ander omstandighede, bv. in voorbereiding op en onmiddellik na 'n groot operasie op 'n diabetiese pasiënt. Oor die algemeen is dit gewis makliker om alleenlik insulien van die oplosbare soort gedurende hierdie twee tydperke te gebruik, aangesien 'n oordeelkundige fout maklik reggemaak kan word met òf suiker aan die een kant òf meer insulien aan die ander. Hier moet 'n mens egter versigtig wees, want 'n groterige dosis van lankwerkende insulien op die dag vóór die operasie mag nog altyd aan die werk wees, en, as die pasiënt vastend is, mag dit selfs tot hipoglisemie lei. 'n Pasiënt met akute tussenkomende vergiftiging word makliker en veiliger beheer met insulien in oplosbare vorm. Aan die een kant is die vergiftiging geneig om insulien te weerstaan en ketose te veroorsaak, terwyl die pasiënt se betreklike aptytverlies geneig is om hipoglisemie te voorsaak. Dit moet verwag word dat daar 'n algehele verandering in die diabetesstatus teweeggebring sal word, met 'n gevolglike verandering in die liggaam se behoefte aan insulien. Dit is in werklikheid verkieslik om met oplosbare insulien te begin as 'n pasiënt hospitaal toe kom vir suikersiektebeheer, aangesien dit in hierdie vorm 3 of 4 maal per dag toegedien kan word. Die dosis kan dan vinnig vermeerder word totdat die gewenste hoeveelheid bereik word, wanneer dit dan met die lankwerkende soort vervang kan word.

Intussen het een na die ander soort insulien sy verskyning gemaak, maar die een wat vervolgens blywende aandag geniet het, was sink protamien insulien (SPI)—'n soort met 'n uitwerking wat oor 36 tot selfs 48 uur strek. Weens die feit dat sy aksie onnodig lank is, en die gevaar van nagtelike hipoglisemie asook die swak beheer wat dit gedurende die dag uitoefen, ontstaan die vraag of die gebruik daarvan nie maar afgeskaf moet word nie. Seer seker moet dit nie deesdae by 'n nuwe pasiënt gebruik word nie. Daar is egter nog pasiënte wat goed klaarkom met 'n mengsel van SPI en oplosbare insulien en wat 'n mens nie graag wil verander nie, soos bv. 'n sekere man wat al jare lank sy suikersiekte baie goed beheer met 'n mengsel van SPI en oplosbare insulien—100 eenhede van elk, apart ingespuit. Die oormaat van sink in die SPI-preparaat maak dit egter moeilik om hierdie twee soorte insulien in dieselfde spuit te meng, want die sink omskep 'n groter of kleiner persentasie van die oplosbare insulien tot nog meer SPI. Daarom moet (1) méér oplosbare as SP-insulien in enige gegewe mengsel gebruik word; (2) die oplosbare soort eerste in die spuit opgetrek word en, (3) weet die geneesheer nooit presies wat hy besig is om te gee nie. Sink protamien insulien is egter nog nuttig by pasiënte wat hul insulien slegs al om die ander dag of selfs tweemaal per week neem, en is blykbaar van veel waarde vir diabetiese honde en ander proefdiere.

Teoreties het globien-insulien 'n middelkoers uitwerking tussen dié van oplosbare en dié van SP-insulien, maar in die praktyk is dit bevind dat dit onbestendig is.

a horse of a different colour. Although in research tests its action looks very like that of globin insulin, with maximum activity in 4-10 hours and lasting up to 18 or 24, clinically it proved much more reliable. It could be mixed with soluble insulin, to get a quicker action, but in many cases it gave, and continues to give, excellent control on its own in a single injection daily. A snag was found in a tendency to hypoglycaemia in the afternoon (or late morning), while with big single doses the hypoglycaemia might occur dangerously during the night. The Americans particularly were dissatisfied with single-dose control and have very widely used NPH night and morning in children and in adults with the 'growth' type of diabetes.

The 'newest' insulins sound complicated but are not really so, and for all-round control many prefer them. These are the 'lente' insulins, containing zinc but not protein. 'Ultralente' insulin is a pure crystalline compound with an action resembling ZPI. It is an improvement on ZPI in being a pure substance and in being miscible with 'semilente' insulin to make a combination with definite and predictable action. 'Semilente' insulin is the same substance but in an amorphous, more rapidly soluble form. Its action is quicker than NPH but less quick than that of soluble insulin. It has been found that a large proportion of diabetics are well suited by a mixture containing 7 of the crystalline to 3 of the amorphous variety, and this stable mixture is marketed as 'lente' insulin. Now if 'lente' insulin alone is not quite suitable in a given case, say because of a tendency to hypoglycaemia in the morning, with the urine showing a brick reduction of Benedict's solution at night, then a reduction of 'lente' with admixture of 'ultralente' is indicated. In another case, where glycosuria appears around lunch time, then 'semilente' insulin may be needed in addition. It is unusual for good control not to be obtained with the 'lente' mixtures, but nevertheless there are some patients who seem to do better on NPH and some very difficult ones where only soluble insulin is practicable. A further advantage that was claimed for the 'lente' insulins was a great rarity of sensitivity reaction, but in fact this reaction is not really so rare.

Finally it should be realized that physiologically-exact control of diabetes is impossible. First, the absorption from the injection site bears no relation to altered bodily needs throughout the day, since it is not under homeostatic control. Secondly, absorbed insulin goes into the systemic circulation, and staining experiments show its highest cellular concentration to be in the kidneys, whereas natural insulin appears first in the portal area and does not concentrate in the kidneys. Some clinicians believe that there is nothing to be gained by aiming at good control of diabetes anyway, but most refuse to be parties to such therapeutic nihilism.

Miskien is dit nie eers nodig om dit te vermeld nie. NPH, 'n protamien-insulien wat nie sink bevat nie (uit Hagedorn se laboratorium), is heeltemaal 'n ander saak. Volgens navorsingstoetse ageer dit baie soos globien-insulien, met 'n maksimumwerking binne 4 tot 10 uur en 'n duurte van 16 of 24 uur. Klinies is dit egter bewys dat dit veel meer betroubaar is as globien-insulien. Dit kan met oplosbare insulien gemeng word om 'n vinniger reaksie te verkry, hoewel dit in die verlede en nog altyd in baie gevalle en op sigself puik beheer uitoefen met slegs een inspuiting per dag. Die nadeel is sy neiging tot hipoglisemie in die namiddag (of laat in die oggend), terwyl hipoglisemie ook in gevaarlike graad gedurende die nag mag voorkom as 'n enkele, groot dosis geneem word. Veral in Amerika was hul ontevrede met enkeldosis beheermiddels, en hulle maak derhalwe dikwels gebruik van NPH, soggens en saans, vir kinders sowel as volwassenes wat aan die ‚groei'-tipe diabetes ly.

Die ‚jongste' soorte insulien is minder ingewikkeld as wat hulle klink, en baie dokters verkies hulle vir algemene beheer. Hieronder tel die ‚lente' insuliensoorte wat sink maar nie proteïen bevat nie. ‚Ultralente' insulien is 'n suiwer kristalverbinding en sy werking lyk soos dié van SPI. Dit is beter as SPI omdat dit 'n suiwer stof is en omdat dit met ‚semilente' insulien vermeng kan word om 'n preparaat met 'n definitiewe en voorspelbare aksie te vorm. ‚Ultralente' en ‚semilente' insulien is eintlik dieselfde ding behalwe vir die feit dat laasgenoemde amorfies is en vinniger oplos. Dit ageer vinniger as NPH maar stadiger as oplosbare insulien. Dit is bevind dat 'n groot persentasie suikersiektelyers goed klaarkom met 'n mengsel van die kristalsoort (7 dele) en die amorfiese soort (3 dele); hierdie stabiele mengsel word bemark as ‚lente' insulien. As die ‚lente' insulien op sigself nie aangewese is by 'n gegewe geval nie (waar hipoglisemie in die oggend mag voorkom en die urine saans al in sterke graad die suikerreaksie van Benedict toon), dan moet minder van die ‚lente' tesame met 'n byvoegsel van ‚ultralente' insulien gegee word. By ander gevalle waar glikosurie so teen die middel van die dag verskyn, mag bykomstige ‚semilente' insulien ook benodig word. Dit gebeur selde dat die ‚lente' mengsels nie goeie beheer uitoefen nie, maar daar is tog pasiënte wat glo beter met NPH klaarkom, en by party moeilike gevalle is slegs oplosbare insulien bruikbaar. Aanspraak is gemaak daarop dat hierdie ‚lente' insuliensoorte baie selde 'n oorgevoeligheidsreaksie het, maar tog kom so 'n reaksie nie regtig so selde voor nie.

Eindelik moet ons besef dat 'n fisiologies akkurate beheer van suikersiekte onmoontlik is. Eerstens bestaan daar geen verband tussen die opname vanuit die inspuitingsplekke en die liggaamsbehoeftes soos hulle gedurende die dag verander nie, daar dit nie homeostaties beheer word nie. Tweedens word geabsorbeerde insulien in die sistemiese bloedsomloop opgeneem en vlektoetse toon dat die digste konsentrasie daarvan in die selle van die niere is. In teenstelling hiermee verskyn natuurlike insulien eerste in die poortgebied en nie in die niere nie. Party geneeshere meen dat dit niks baat om doeltreffende suikersiektebeheer na te streef nie, maar die meeste weier om so 'n standpunt van geneeskundige nihilisme te huldig.

THE PATHOLOGY OF GRAVITATIONAL SYNDROMES IN THE LEG AND THE PLACE OF STRIP GRAFTING IN TREATMENT

2. STRIP GRAFTING IN CHRONIC INDURATED LEG ULCERS*

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This is the first report on a series of strip grafts, a term coined by the author[1] for an operation performed in chronic indurated leg ulcers.

The physiology, anatomy and certain aspects of the pathology involved in gravitational leg syndromes have been described in previous papers.[1, 2] The 115 cases in this series permit an assessment of the procedure and a fuller discussion of its rationale and pathogenesis.

The chronic indurated leg can be regarded as the end result of a variety of causal factors related one to another in a vicious cycle of pathology (Fig. 1). Any one of these factors may control the cycle, which terminates in this

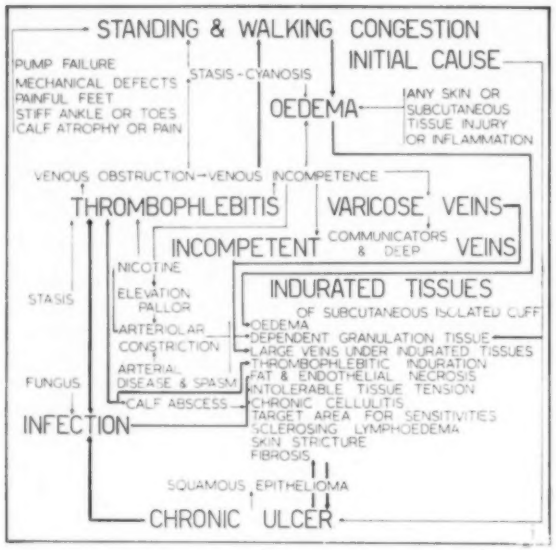

Fig. 1. Interrelated factors in the vicious cycle of pathology.

type of indurated leg. Fig. 2 illustrates a number of conditions which can be combined in one or another way to produce the individual clinical problem, and from this figure the various numerous permutations clinically possible can be gauged; e.g. a fat person with simple varicosities may have a traumatic ulcer and a dropped foot with a shortened tendo Achillis. This combination may result in a chronic indurated leg. It will therefore be clear that the clinical problem is a complex one, requiring careful diagnosis as well as selection of the case for appropriate treatment. The present analysis also demonstrates the complexity of the various factors responsible for a particular case. A purely statistica evaluation of results is clearly misleading. Each case must be considered on its own merits.

Current operative procedures commonly include treatment of varicosities, groin ligations of the saphenous tree, popliteal ligations, and sympathectomy. These operations, however, do not direct treatment to the actual site of the pathological process. The focus of interest in strip grafting is directed to the area which is prone to the maximum effects of congestion and high venous pressures in varicose veins, post-phlebitic conditions and deep-vein incompetence. It is the area to suffer from subcutaneous trauma, infections and phlebitis more readily than other parts of the body because of isolation by the deep fascia. This has been described by the author as the 'isolated cuff'[2,2]; this area and that behind the malleoli are the areas most liable to suffer from the development of dependent granulation tissue.

Because of the progressive oedema and high venous and capillary pressures, superadded infection leads to intolerable tissue tension, resulting in extensive tissue destruction with slough or diffuse skin reactions. It is in these areas that ulceration develops, with irreversible changes such as scar, skin stricture and chronic lymphoedema. There is a clinical suggestion that the target area for the development of allergic reactions in these cases may be contained in the area affected by the induration, i.e. the area of the focus of interest. Excision with strip grafting usually results in a disappearance in a relatively short time of allergic local and general skin reactions.

The operation of strip grafting has been devised by the author for indurated and ulcerated legs[1] with the following objects (Fig. 3):

1. To attack the focus of interest by excision of the isolated indurated and irreparable subcutaneous tissue over the deep fascia, with inclusion of the deep fascia, viz. the isolated cuff.
2. To provide a soft vascular muscle-base with the healthiest portion of the leg as the centre of the graft. Softening of the surrounding indurated tissues occurs so that the operation appears to provide a new lymphatic watershed.
3. Excision of varicose veins and perforators with provision of a thickened split skin graft which supports directly incompetent veins more efficiently than any other known method.
4. Removal of unhealthy skin, whether it be intolerant skin or ulcerated skin with chronic fibrous scar or even, on occasions, with carcinomatous change in the ulcer.
5. Excision of subcutaneous tissue which is the site of fat necrosis or necrosed veins, and replacement by graft.
6. Removal of the source of antigens responsible for allergic skin-reactions.
7. Removal of the area already waterlogged and prone to develop intolerable tissue-tension.
8. Lengthening of the tendo Achillis with improvement of ankle movements.

*The first article was published in the issue of 30 April 1955, p. 399

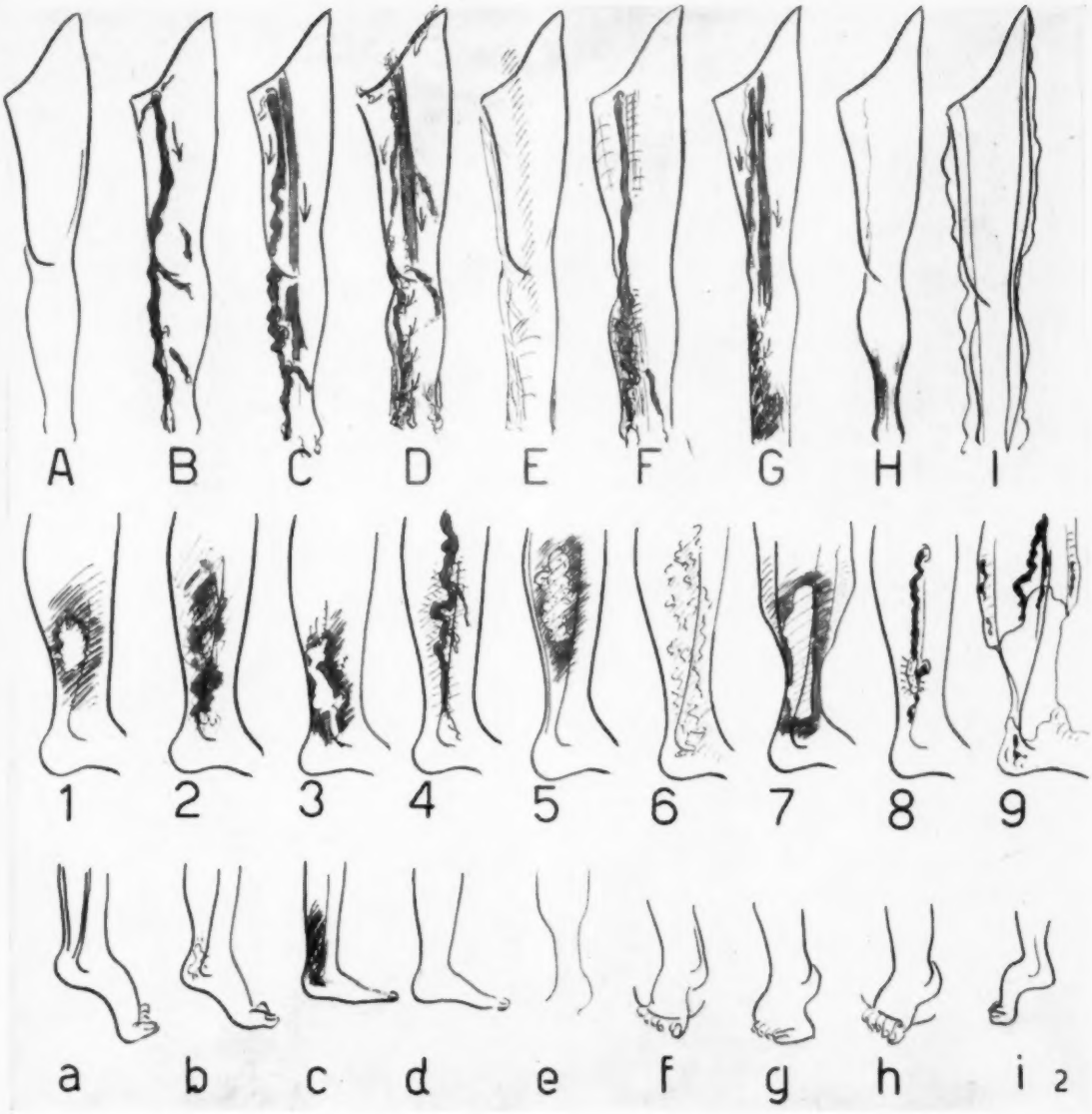

Fig. 2. The various conditions which can be combined to produce the individual type of case.

A—Normal. B—Varicose veins (simple). C—Varicose veins with deep vein incompetence. D—Post-phlebitic with deep vein incompetence. E—Pale oedema without varicose veins in a post-phlebitic. F—Congested oedema with varicose veins in a post-phlebitic. G—Flush syndrome in a post-phlebitic. H—Skin stricture and pigmentation. I—Stature differences—adipose, normal and thin.

1—Chronic inflamed ulcer. 2—Haematoma or scurvy with induration. 3—Traumatic ulcer. 4—Superficial thrombophlebitis with induration. 5—Calf abscess after thrombophlebitis. 6—Skin reaction with inflammation. 7—Ulcer and scar stricture. 8—Ulcers with underlying varicose veins or perforators. 9—Worst type of case.

(*a*) Short tendo Achillis and claw toes in the fallen transverse arch. (*b*) Malleolar ulcer with pain and dropped foot, shortening of tendo Achillis and claw toes. (*c*) Stilt walking, flat footed, no spring, little knee and ankle movements. (*d*) Normal. (*e*) Bottle-neck leg. (*f*) Fungus foot infection and lymphatic obstruction with foot deformity. (*g*) Hallux valgus. (*h*) Metatarsus atavisticus, mobilis, elevatus and hallux rigidus; callosities, fixed claw toes and fallen fore-foot. (i) Pes cavus and congenital abnormalities.

9. Excision of the saphenous nerves and ulcer with scar removes pain completely. This is the main factor causing disability.

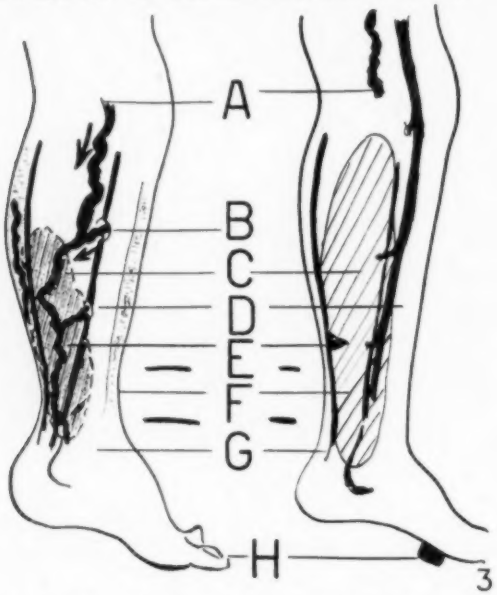

Fig. 3. Principles underlying rationale of strip grafting. A—Varicose veins treated (excised in graft area). B—Incompetent communicating veins ligated and divided deep to deep fascia. C—Ulcer and scar and indurated 'isolated cuff' excised and replaced by skin graft on healthy muscle base. D—Surrounding indurated tissue softens. E—Shortened tendo Achillis lengthened at muscle level. F—Skin stricture relieved by 'let in' graft. G—Ankle movements impaired after treatment of scar, pain and shortened tendo Achillis. H—Faulty foot-mechanics corrected.

THE SELECTION OF CASES

1. *Cases Unsuitable for Strip Grafting*

(*a*) *The Most Advanced, Incurable Cases.* This is the worst form of leg (Fig. 4). There is gross venous incompetence, with congestion on standing, varicosities, oedema, ulceration and infection, gross induration and pigmentation, necrosis with fatty degeneration of muscles, limitation and fixation of ankles, furry elephantiasis of distal skin, periostitis and osteitis, and frequently arterial degeneration by reason of repeated infection in the arterial wall. This type of case is only fit for amputation.

Case 1 (*Fig.* 5)

Mr. van B., aged 57 years, had a history of right leg ulceration for 15 years following a thrombosis of both legs. In 1944 he was hospitalized with a very large ulceration of the lower right leg. Considerable induration was present all round the ulcer, which bled as soon as he stood up. The bleeding invariably stopped on elevation of the leg.

There were dilated veins above the ulcer in the calf, and a crepe bandage, applied from mid-calf to the inguinal region, immediately distended these veins on standing. They collapsed on elevation of the limb. Dilatation of superficial veins was accompanied by pigmentation of the overlying skin. The ankle was fixed by the dense scar and induration of the subcutaneous tissues about this joint. Pulses could not be felt since the arteries were involved in surrounding scar. The calf was indurated and firm.

Diagnosis—Chronic ulceration following an old thrombosis with deep-vein reflux and superficial varicosities, a fibrous indurated calf, and a fixed ankle. On the opposite side the arterial pulses were impalpable and some pigmentation was present in the lower tibial regions, with an atrophic skin but no ulceration. On this side skin-temperature responses were relatively poor, but they were good on the side of the ulcerated leg. Buerger's disease was considered, but the good temperature-responses in the ulcerated leg made this unlikely (? masked arterial disease or ? Buerger's disease).

At this time skin grafting was done for the ulcer of the left leg without the strip grafting method. The patient left hospital with the ulcer healed, wearing firm elastic pressure-bandages.

It is not surprising that he returned in 1948 with an enormous ulceration in his left leg (Fig. 5), elephantiasis and a chromoblastomycotic appearance of the foot, and with hyperkeratotic, fluffy, papillomatous-looking skin suggestive of lymphatic obstruction. Neither filariasis nor chromoblastomycosis could be demonstrated. Osteitis was present. A profuse growth of *B. pyocyaneus* was obtained. *S. aureus* was also present. A below-knee amputation was done.

Dissection of the Specimen. The ulcer was surrounded by dense scar which was entending to deep fascia. There was a thickened fibro-fatty sub-fascial covering to the underlying calf muscles, which were pale yellow (almost bloodless at operation) and oedematous. The deep long vessels were plastered between the bones and surrounded by layers of fibrous tissue. The ankle was fixed by reason of skin stricture, fibrosis about tendons, and narrowing of the joint space. Chronic osteitis was present in both tibia and fibula.

Case 2 (*Fig.* 6)

Mr. J.J., aged 58, suffered from chronic ulceration of the left leg and foot for 42 years. The initial cause was an injury at 16

Fig. 4. Diagram of most advanced, incurable case. A—Indurated subcutaneous 'isolated cuff'. B—Chronic ulcer. C—Few muscle collaterals. D—Varicosities thrombosed or patent and incompetent communicators. E. Pale, degenerated calf muscle. F—Osteitis. G—Stiff ankle. H—Thickened elephantoid state of subcutaneous tissues of foot with furriness. I—Extent of 'isolated cuff'. J—Skin stricture. K—Straight, valveless deep veins.

Fig. 5. Case 1.

years of age, when he cut his leg on a stone in Madeira. In 1930 (23 years before) he was treated in Lourenço Marques. Temporary healing took place. For 5 years the ulceration has been very extensive. He smoked 10 cigarettes and drank 1-2 brandies or wine daily. There was fixed flexion of 45° at the left knee; also gross thickening and swelling, with extensive ulceration, completely encircling the leg, with bleeding on standing. There was a furry elephantiasis of the foot and pigmentation on the foot and above the ulcer to the knee. The Kolmer, Cardiolipin and Wassermann tests yielded negative results. Swabs revealed *B. proteus* and diphtheroid bacilli. No fungi were found on microscopy or culture.

Skin Temperature Tests. The toes were warmer on the affected side. Heating the hands gave a better response on the affected than on the unaffected right side.

On 29 April 1953 the ulcer was excised on the anterior, posterior and lateral sides to the dorsum of the foot, deep fascia being removed and muscle exposed. The underlying muscle appeared unhealthy, pale and fatty, only a little dark-coloured blood following its incision. This contrasted with the pink vascularity of the subcutaneous tissues. There was a good covering of fatty areolar tissue over the tendons. Over the dorsum of the ankle the scar tissue was about 2 inches thick; on incision, bright-red blood shot out, but a swab applied with some pressure stopped bleeding without any necessity for ligation. Thiersch grafts were applied to the raw areas, but the presence of multiple minute sequestra of the tibia and fibula in the base of the ulcers, and the poor state of the muscles, did not give much hope of permanent success. On 9 June 1953 amputation was performed above the knee.

Dissection of the Specimen. Gross thickening of subcutaneous tissue in the ulcerated areas and distally in the foot (even where healing had occurred) was noted. The tibia and fibula were sclerosed. There were irregular spicules and one larger fibular sequestrum with oedema under the periosteum (which was thickened where it was not destroyed by ulceration). The muscles (pale and fatty with minimal muscle fibres) were oedematous throughout. Very few vessels were located in the muscles. The major veins showed no gross dilatation, but sclerosed longitudinal channels were present, hugging the major arteries.

(*b*) *The Presence of Arterial Disease.* The case to shun is that of the elderly patient in whom there is an ulcer on the lateral aspect of the lower leg with a deep centre in which there are muscle and tendon sloughs, poor granulations and little or no bleeding of the ulcer, and in whom the oscillometric cuff shows little or no pulsa-

Fig. 6. Case 2.

tion at the ankle. The danger of operation on patients with arterial disease is illustrated by a patient who had venous disease with pigmentation, malleolar and supra-malleolar ulcers on the medial side of the lower leg, causing pain but little or no sypmtoms referable to arterial deficiency. Oscillometric study alone revealed the absence of pulsations at the ankle. In the standing position an adequate circulation was present. Against the author's advice, treatment of the varicose veins was undertaken. There was immediate post-operative evidence of arterial deficiency, slough of ulcers and rest pain. Amputation therefore had to be performed. The term 'masked arterial disease' is dramatically applicable in such a case.

(*c*) *The 'Iron Calf' Syndrome.* A condition which requires differentiation is the induration resulting from an acute, subacute or even chronic abscess in the calf with secondary subcutaneous induration—the condition described by the author as the 'iron calf' syndrome.[1] In these cases (if they are diagnosed correctly) a linear incision through the deep fascia will allow removal of slough and drainage with eventual healing, a soft calf and a linear skin-scar without the necessity of a strip graft.

2. *Cases Difficult to Strip-Graft*

Osteitis. This complication is shown by periosteal new bone, thickening of the bone, and ulceration over the bone. It is regarded by Boyd[3] as a contra-indication to surgical measures directed to a cure since no good results can be expected in such cases. However, this is not necessarily the case, unless *B. proteus* infection and local 'inflammatory' endarteritis coexist. If the ulcerated area over bone is not extensive, a skin graft on this area supported by strip grafts on muscle on both sides of it (medially and laterally) may result in permanent healing.

Even a local area of osteitis with a sequestrum may remain as a permanent area of ulceration after removal of the sequestrum and strip grafting; but certainly this does not mean that strip grafting does not provide relief of pain and improved movement and activities. The operation is acclaimed by the patient as a great success. A small ulcer over the malleolus may, in such circumstances, be quite manageable, and in the patient able to afford some time for further elevation and plastic procedures to the skin (e.g. rotation flaps or cross-leg procedures) permanent healing may be possible.

Furthermore, in osteitis of the fibula this bone can be excised, with grafting on the soft vascular bed.

3. *Cases with Possible Recurrence*

Possible recurrence may occur in certain types of case unless special care is afforded:

(*a*) This group includes patients who by reason of their stature, adiposity, joint stiffness, etc., cannot attend to the cleanliness of their feet, or who are unable or unwilling to maintain normal cleanliness.

(*b*) It is also necessary (before strip grafting) to assess the site of the ulcer and to record other areas of scar or of devitalized tissue, for it is not uncommon for patients to return later with ulcers in other areas of scar and in areas away from the original strip graft. It is important, also, to estimate the state of the skin. One example is the thin skin which for unknown reasons continues to ulcerate without the development of much fibrosis—a skin which may be classified as an atrophic, intolerant skin. Another is the skin with a widespread erythematous or bullous or superficially ulcerated condition, with or without secondary infection and cellulitis, with gross massive induration, giving an appearance as if there is insufficient skin to surround the underlying tissues under tension. The subcutaneous tissues in such cases are excessively vascular and weep fluid when incised; a thick white lymph can be expressed and areas of necrosis are apparent. It is in this type of case that the term 'massive intolerable tissue-tension' may be used. The oedema *plus* infection and congestion results in a relative skin stricture with resultant widespread skin reactions. In the later stages, where ulceration leads to scarring, there may be a true skin-stricture even in the non-oedematous leg. This will the more easily suffer from the effects of oedema and infection. Strip grafting on muscle on both sides of the same leg provides relief of the skin stricture as an important measure in the treatment of such a case. The effect of a solid cuff around the lower leg in these cases is comparable with the wearing of a Baumanometer cuff about the leg, blown up somewhat so that venous pressures distally may be permanently higher than elsewhere. The result is oedema, thickening, lymphatic induration, pigmentation and ulceration (particularly at the bases of the toes) and elephantiatic furry thickening. Permanently dilated capillaries as well as veins will result in the standing position, with emptying on elevation so that the well-advanced flush syndrome becomes established.

(*c*) Infection itself is of some importance and pre-operative cultures and sensitivity tests are routine measures. The cases which present with sloughy areas, and which may heal after operation but tend to recur even after healing, are often associated with infection with *B. proteus*, *B. pyocyaneus* or a diphtheria-like bacillus. The presence of dangerous organisms cannot always be assessed from the appearance of the ulcer. This is demonstrated by one dramatic case where the swab result was received the day after a strip-graft in a clean-looking ulcer; by this time the patient already had an acute streptococcal scepticaemia which, however, fortunately settled down with chemotherapy.

(*d*) In selected cases one must also recognize the pseudo-Buerger syndrome. A case may be classed as Buerger's disease and operation on the toes or legs held to be highly dangerous, when actually there is no danger and healing will occur, possibly even better than normally.

Case 3

Mr. A.H.M., 43 years of age, suffered from 'pneumonia' in 1936 and a thrombo-phlebitis with swelling of both legs, calf pains, and numbness of the toes and feet. In 1941 he was subjected to para-vertebral lumbar blocks and a lumbar ganglionectomy was performed on the left side. This was followed by relief of pain for 18 months. He had more attacks of thrombosis and Buerger's disease was diagnosed. After further attack of 'pleurisy' and 'pneumonia' in 1938 he was off his feet for a long time. In January 1949 he had bilateral oedema of the lower legs. There was gross varicose pigmentation of both legs and varicose ulcers, with pain in the legs and feet, which was relieved by sitting down. He had occasional

cramps in bed at rest. Since 1936 he had been unable to walk or work.

There was intense congestion of both legs on standing and tense dilated superficial varicosities. On elevation there was considerable blanching of the legs and toes, with emptying of the veins. The feet were very deformed and painful, but warm, with hallux rigidus and osteo-arthritis with shortening and elevation of the 1st metatarsal. The transverse arches were dropped and the toes were all clawed and rigidly fixed (clawed toes). Three large tender callosities were present under each foot. There was clinical evidence of bilateral deep-vein reflux, and there was a history of sensitivity and widespread dermatitis.

This case was treated by bilateral superficial femoral vein division, strip grafting on both sides, first medially and later on the outer sides. Bilateral Girdlestone peg operations were performed and the 1st metatarsal screwed to the 2nd after osteotomy. The callosities were removed as well as the proximal phalanges of the toes. The patient was supplied with metatarsal bars and elastic stockings and encouraged to do extensive exercises in the lying position followed by long walks. The grafts and wounds all healed without any trouble. There was no pain, but a considerable tendency to swelling and congestion persisted. Walking was greatly improved and the feet were always warm.

After this treatment he was able to obtain employment. There has been some swelling and tiredness, and minor areas of ulceration behind the malleoli; but whereas he had worked 2 weeks in 2 years (1943-1945), he has now been continuously employed and has been off work for only about 4 weeks in 2 years. He suffers no pain and is able to walk to work.

In the selection of cases there is also the problem involving a decision whether a full-scale excision of subcutaneous tissue and fascia should be done with strip grafting, or a linear incision with excision of subcutaneous induration and deep fascia, ligation of incompetent perforators deep to deep fascia, and excision of incompetent varicosities with re-suture. This may be called modified Linton procedure, although it involves more than excision of the veins and perforators (Linton),[4] since wide excision of deep fascia (Kondoleon) and further excision of indurated subcutaneous tissue are carried out. This operation, in the experience of the author, has not been as satisfactory as strip grafting; in the immediate post-operative period it is followed by persistent induration pain, oedema and restriction of ankle movements.

Selected cases of the pre-ulcerative type can also be treated by strip grafting; e.g. where there is persistent induration and pain with repeated thrombosis in the veins below the knee, which is not relieved by conservative measures and treatment of varicosities at a higher level. The results in 2 cases of pre-ulcerative lesions of this nature have been highly satisfactory.

THE STRIP-GRAFT OPERATION

Technical Considerations

A slight Trendelenburg position is utilized to decrease bleeding. The area to be excised is marked with Bonney's blue. The indurated tissue about the ulcer, and the ulcer itself, are excised. The excision is carried upwards to the upper part of the lower leg so that a broad base on normal tissue can be obtained. The incision starts above and is carried through to the deep fascia. Once under deep fascia, excision by scissors is carried out, with the finger directing the course. Some difficulty may be met at the ankle, where it is best to excise in layers until a soft subfascial base is present. A muscle base is desirable. Sometimes tendons seem to predominate in the base, but fascial cover is kept over these. In most chronic ulcers there is a layer of soft fatty areolar tissue over muscle and tendons on which the graft can be placed.

Bevelling of the skin edges improves the final result. All superficial veins are removed in the excised area, and perforating vessels are ligated and divided as they leave the intermuscular planes. As the ulcer area is approached, the superficial tissues become more and more thickened and firmly adherent to the underlying fascia, which may be fused in one indurated mass. However, it is always possible to dissect beneath the indurated tissues, under deep fascia, except for occasional indurated septa which are cut off short. A soft base presents, and deficiencies through which the perforating vessels have traversed must be closed.

When excision of the indurated areas is completed, it may still be impossible to dorsi-flex the ankle to a right angle or more; the tendo Achillis can then be lengthened at muscle level, by tenotomy of taut fibres at varying lines, and the incised areas placed under the fascia by an adjusting catgut stitch.

A split skin graft, usually in one piece, is applied to the healthy base, and the foot splintered at a right angle.

Post-operative Period

The post-operative splintage is usually in the form of a back splint with an adjustable knee. In women, and especially if both legs are operated on simultaneously, plaster-of-paris immobilization has the advantage over back splinting for nursing. The crepe-bandage pressure-dressing need not be very tight. Too tight bandaging may cause pressure necrosis over the dorsum of the ankle. The use of large quantities of cotton-wool padding, and only moderately tight crepe bandages, prevents this. When pressure necrosis occurs it takes longer to heal than the skin graft, and it is thus a serious complication. Chemotherapy is used for about 5 days. Pain in the grafted leg during the post-operative period usually indicates too tight bandaging, but occasionally it is caused by infection, which, if it does occur, is usually localized to one area and does not affect the take of the graft as a whole. When the donor areas are more painful than the grafted leg, this is usually a good sign. The down-take is painful and this should be anticipated by appropriate medication.

DISCUSSION AND ASSESSMENT OF RESULTS

1. *Clinical Types of Cases*

The 115 strip grafts in this series were performed on 86 patients—55 females and 31 males. The average age was 49 years.

The stature of the cases was as follows:

Normal average	27%
Small squat	31%
Grossly adipose	15%
Large solidly built	14%
Tall long-legged	13%

Approximately 70% of the male patients were in the tall, long-legged category, with bilateral involvement of the legs.

In 75% of all cases there was evidence of deep-vein thrombosis after child-birth, illness or trauma.

2. *Duration of Ulcers*

The average duration of the ulcers was 11 years. Of the 86 cases, 14 cases had had ulcers for over 20 years, 37 for 10-20 years, and 35 for under 5 years. There was no evidence of diminished healing in the 14 cases suffering from ulcers for over 20 years; all grafts were successful in this group and remained healed.

The longest duration was that of a woman 74 years old who had had a persistent ulcer for 57 years. She injured her leg in the South African War and subsequently developed a thrombophlebitis. The ulcer was anterior and lateral and extended deeply, but in spite of calcification of thrombosed veins one could hardly call this ulcer, which started at the age of 17 years, an arteriosclerotic ulcer. Lateral and medial strip grafts and cover to the anterior part of the ulcer resulted in an excellent take and healing. This case controverts the view[3] that anterior and lateral ulcers are typically arteriosclerotic.

3. *'Take' of the Grafts*

Healing of the graft takes place within approximately 5 to 7 weeks.

In cases where there is little odour from the grafted area the dressing and plaster can be left undisturbed up to 21 days, when the down-take will be less painful and the skin graft thickened considerably. This is a great saving in dressings and, if conditions permit, allows the patient to be at home in bed. After this period the residual unhealed areas are dressed. When they are healed, a pressure dressing is applied in the form of 3 layers of crepe bandages with a roller Elastoplast bandage. This is left on for periods of 3-5 weeks until firm healing without congestion has become established.

At first the large area of depression may be unsightly (Fig. 7). This fills up later, especially in thin patients, and, by reason of the position of the graft, it is hardly noticeable in the stockinged leg. Bevelling the skin edge helps the appearance and a wide graft also looks better than a small thin graft.

4. *Results of Strip Grafting*

In this series patients with 100 strip grafts were followed up closely for varying periods up to 9 years. The results were consistently good with regard to relief of pain, increased activities, improved ankle movements and improved morale, and variable with regard to swelling and permanent healing. Skin rashes often improved or disappeared.

5. *Recurrent Ulcers*

Definition. It is misleading to classify all cases developing leg ulcers after strip grafting as recurrent ulcers, which are more correctly classified as follows:

(*a*) Avoidable recurrent ulcers due to technical errors (5%).
(*b*) Recurrent ulcers away from the grafted area and therefore unavoidable and due to other untreated factors (8%).
(*c*) Minor recurrent ulcers in relation to the graft or its edge (11%).
(*d*) Major recurrence on the graft (5%).

Fig. 7. Strip graft after 4 years.

This gives a total of 29 of the 100 followed-up grafts, as follows:

(*a*) *Recurrence due to Technical Errors* (Fig. 8). (i) When the graft is too small, or sepsis or poor take has caused an area to contract, the surrounding skin and subcutaneous tissue remains indurated (2 grafts).

(ii) If the deep fascia under the ulcer and graft is not removed and a soft muscle and sub-fascial base not procured for the graft base, no result can be expected (1 graft). Even if temporary healing occurs, the ulcer will break down and pain is often aggravated.

(iii) Too early rising after grafting, when small ulcers are still present and when dependent granulation tissue still persists, may result in residual unhealed ulcers in an otherwise healthy graft (1 graft). (Rest and compression should be continued until the granulation tissue has faded and the graft thickened sufficiently to support incompetent veins, and the surrounding skin has softened. Time should be allowed for the venous tree to regain some tone and contraction, at rest, and the patient, his muscles and ankles and feet strengthened by exercises, is more able to withstand the rigours of the upright position without an early break-down.)

(iv) At the time of strip grafting all incompetent

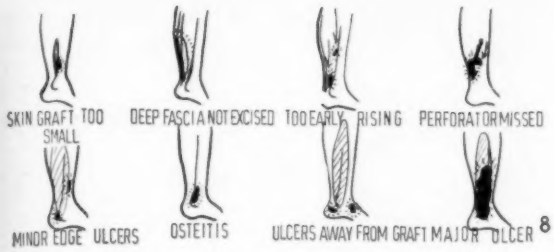

Fig. 8. Summary of causes of recurrences.

veins are excised in the area; but occasionally a dilated tense varicosity develops at a later date under or at the edge of the graft and the overlying skin becomes inflamed and oedematous (1 graft). An incompetent perforator may be missed at operation, and further division of this vein has resulted in healing of the overlying skin lesion.

(*b*) *Unavoidable Recurrences Independent of the Graft* (Fig. 8). (i) An osteitis of the medial malleolus with sequestrum may prevent healing in this region (1 graft).

(ii) Ulcers at sites remote from the strip graft, e.g. lateral side, behind the malleolus (5 cases), when the medial side had been grafted. In these cases the post-phlebitic congestion has become manifest behind the malleoli as well as on the medial supra-malleolar area (Fig. 9). Skin grafts after clearing the perforators in these sites were done later.

(*c*) *Minor Recurrent Ulceration in Relation to the Graft or its Edges* (11 grafts). These small ulcers develop mostly after injury or local infection. Although they may resemble the original ulcers, bed rest and dressings produce rapid healing. The soft base on muscle and the healthier state of the surrounding tissues, without fibrosis and isolation of the subcutaneous tissues, allows a normal response with early healing. In some cases the application of a dry gauze dressing with a sponge rubber pad, 3 crepe bandages applied from toes to knee with a roller Elastoplast to follow, is sufficient for firm healing, especially if the bandaging is renewed, after healing, for another 3-5 weeks.

(*d*) *Major Recurrences of Ulceration in the Graft* (5 grafts in 4 patients). Large areas of recurrent ulceration on the graft and its edges seemed to occur in patients who neglect injury to the legs or infection, either from difficulty in bending, or the necessity for continual ambulation. Bed rest and specific treatment of the infection gave surprisingly rapid cover with healthy granulations. A skin graft was followed by further healing. When healed the patients were very satisfied but all these cases had considerable bony thickening and periostitis on X-ray, and recurrence is usual. In one patient excision of the lower portion of the fibula afforded a soft base compatible with healing, but this leg was later amputated below the knee because of malleolar osteitis, *B. protens* infection, endarteritis, and local arteriolar thromboses.

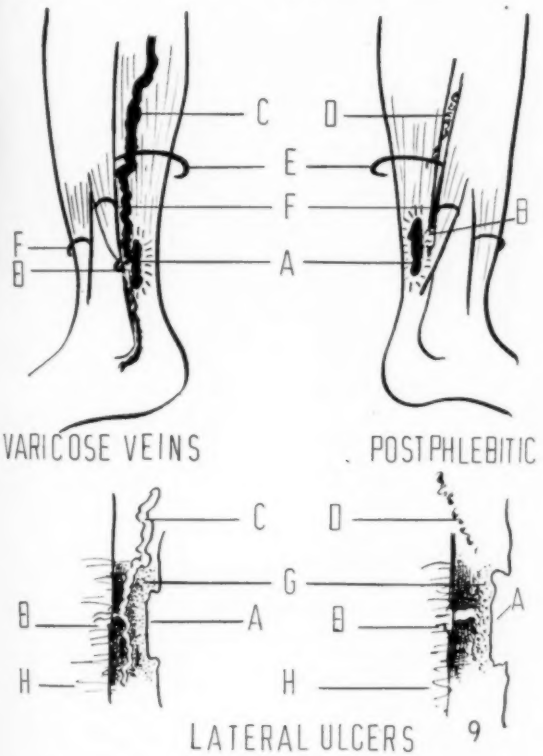

Fig. 9. Two cases of lateral ulcers. A—Lateral ulcer. B—Perforator vein under ulcer (large in post-phlebitic). C—Varicose vein (feeder to ulcer). D—Thrombosed communicating vein in post-phlebitic. E—Extent of subfascial compartment underlying the 'isolated cuff'. F—Deep fascial coverings to isolated muscle with intervening septa. G—Dependent granulation tissue. H—Underlying septal thickening, otherwise no widespread induration.

Case 4

This female patient aged 52 had suffered from leg ulcers for 20 years. She had an extensive encircling ulcer of the left leg, *plus* foot-drop and clawed toes. On the right side a massive ulcer, covering half the circumference of the leg below the knee. was present. The patient had spent the last 5 years in bed. She was adipose and crippled with rheumatism.

Medial and lateral strip grafting on the left leg (with cover of the intervening areas) and strip grafting of the medial side of the right leg, resulted in completely healed areas for 2 years. She also enjoyed comfort for this period, although still crippled with rheumatism (she was unable to reach below her knees). A small traumatic ulcer formed on the edge of the graft. She did not rest and was finally admitted to hospital with a large ulcer and cellulitis of the right leg. A minor ulcer was present on the left leg. A further skin graft was applied, enlarging the medial graft with extension through a ring of indurated tissue about the ankle which had not been touched at the previous operation. Strip grafting on the lateral aspect was performed as well. The patient left hospital healed, but recurrence is expected.

Case 5

This male patient aged 47 years had a thrombo-phlebitis (following pheumonia) and chronic medial leg ulceration for 15 years. Strip grafting had been done by someone who threaded a whole-thickness skin strip through the ulcer without excising ulcer or fascia. Following further severe infection and swelling a massive strip graft was undertaken, after attempts to eradicate *B. pyocyaneus* and *B. proteus*. Although the take was fair, small persistent ulceration and induration with greenish pus persisted about the

malleolus and graft edges, which finally healed, but ulceration recurred within 3 months. Lumbar sympathectomy was performed and further grafting healed the ulcer, but the offending organisms persisted.

Case 6

A female patient aged 41 years had a painful right leg ulcer for 12 years. She had been confined to bed for 2 years with fixed foot-drop and clawed toes. The shortened tendo Achillis and the clawed toes were treated. Strip grafting allowed healing and return to duties as a dentist's nurse, with healing and comfort for 3 years. The strip grafts were rather narrow and a recurrent ulcer formed 5 years later, requiring re-grafting and enlargement of the original graft area. She is now still working.

Case 7

A male patient aged 30 years had a left-sided leg ulceration for 4 years. This had been treated by direct skin graft (fascial excision being omitted) without success. A lumbar sympathectomy and an extensive strip graft was successful after a severe pyogenic dermatitis had been overcome temporarily. Re-hospitalization was necessary 2-3 months later for a very severe furunculosis, most marked on the graft. The patient was disinclined to rest. This case was classified as a failure. However, 6 months later the area had completely healed and remained so.

6. *Oedema*

In most cases oedema was less marked after strip grafting, though in 7 oedema remained prominent.

After excision of the firm indurated cuff in the tissues of the lower leg and its replacement by a soft graft, swelling may appear to be aggravated for a short period. Six weeks of bed rest has weakened the muscles and caused prolonged arteriolar contraction, and the treatment has removed many venous channels. For this condition the patient is encouraged to do very extensive leg movements in bed, including cycling exercises on a bicycle fitted to the bed, as well as other exercises, while firm compression is applied to the legs below the knees. This is continued after healing in hot baths while a lightly applied Esmarc's bandage is worn. Graduated periods in the erect position are permitted, according to the feeling of skin tenseness and heaviness.

When excessive oedema forms and there is no infection, an inflated Baumanometer cuff is applied distally and exercise is performed for a short period, after which, on removal of the cuff, the oedema is seen to have disappeared and the skin and subcutaneous tissues are found to be soft. The cuff is placed progressively higher until the oedema is removed to the knee level. Bandages are re-applied and the routine exercises and graded return to walking continued. Eventually the patient can walk 3-5 miles a day, the oedema gradually improving. The degree of swelling does not correspond with the tendency to ulcerate.

In 2 adipose patients the pre-operative state was a chronic indurative thrombo-phlebitis with massive indurated swelling of both legs. Strip grafting gave relief of pain and induration. Tense oedema persisted but improved within the following 3 months. The gross congestion and inflammatory phlebitic induration encircling the legs causes gross oedema. The loss of support to the lower leg (even if that support was an inflamed fibrous cuff) is reflected in moderately severe, painless oedema which gradually improves. When infection is superadded, oedema is aggravated. When the feet are painful oedema is inevitable (case 3); the patient walks as if on stilts, is overweight, and stands about rather than walk.

SUMMARY AND CONCLUSIONS

The rationale of strip grafting (Fig. 3) is based on the following points:

1. The focus of interest in the treatment of chronic indurated leg ulcer is the medial supra-malleolar region and behind the malleoli. This area is attacked in strip grafting by:

(*a*) Excision of ulcers, indurated subcutaneous tissues and scar.

(*b*) Grafting a strong healthy skin on muscle.

(*c*) Better support to congested veins offered by such a graft. Radical excision and ligation of incompetent veins is possible at intermuscular level.

2. The most consistent result of strip grafting is relief of pain. Improved activities, increased movements and raised morale are striking and the number of recurrences is lower than in any known series of cases treated by other methods. An analysis of the types of recurrences indicates the importance of the individual assessment of cases rather than generalizations on a broad statistical basis. Although the recurrence rate *in toto* was 29%, only the patients with major recurrent ulcers (5%) could be regarded as not having benefited significantly. Even in these, healing was more rapid with routine measures than before the grafting. Once technical errors were corrected, the condition of patients in this group (5%) became satisfactory. The group with ulcers away from the grafted area (8%), although a disappointment to the patient, could not be regarded as a failure of treatment. In terms of the satisfied patients, the result was nearly 90%, compared with the figure of 71%, if one deducts all recurrent ulcers without analysis of the position.

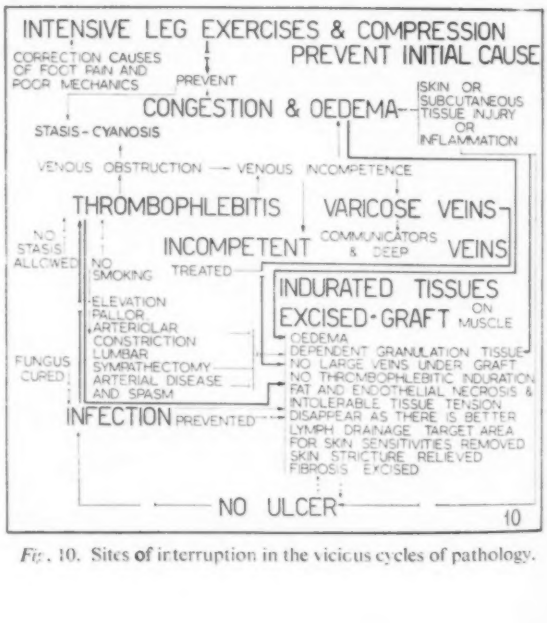

Fig. 10. Sites of interruption in the vicious cycles of pathology.

3. Certain other side-effects are worth noting. The tendency to skin rashes after a successful skin graft is reduced in this series. It is also evident that some psychological improvement occurs after strip grafts in patients with chronic leg ulcers. The increased activities and absence of pain are the main factors.

4. This study indicates that strip grafting plays an important part in the treatment of chronic indurated leg ulcers. The points in the two series of vicious cycles where strip grafting acts are shown in Fig. 10. There are, however, other important forms of treatment in these cases; e.g., venous ligation and stripping, lumbar sympathectomy and treatment of foot deformities are sometimes indicated. General physical and mental health are essential factors for permanent success, and therefore diet control, exercises, and hygiene discipline are of great importance.

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RADIO-ACTIVE ISOTOPES IN THE TREATMENT OF BLADDER TUMOURS*

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Cancer of the bladder is a painful and fatal disease, and any method of treatment which may help in any way to alleviate the sufferings of these patients is worth a trial. Cooperation between the urologist and the radiotherapist is of vital importance in deciding the best method of treatment and each patient requires the combined efforts of both specialities. Until the advent of radio-active isotopes, the diathermy button, surgical extirpation of the growth (partial or total cystectomy) and the use of radium, radon and X-ray therapy were the usual methods available. The treatment of choice depended on the type of growth. Transplantation of the ureters into the bowel appears to be going out of favour, owing to delayed post-operative biochemical upsets; and the formation of an artificial bladder from small bowel is a major procedure to add to a cystectomy.

Whereas surgery or radium implantation remain the treatment of choice in infiltrating tumours without spread to the pelvic wall, radiotherapy now has a great deal more to offer the patient with superficial lesions. In a country where bilharziasis is common, and superficial bladder tumours of the papilliferous type are more commonly seen than in many other countries, the various radio-active isotopes should prove of great value.

A great deal of the pioneer work in isotope treatment for bladder lesions has been carried out at the Royal Cancer Hospital, London, where radio-active tantalum wire has largely superseded radon seeds for implantation of the solitary malignant papilloma of the bladder. Many urologists will be familiar with the difficulties of obtaining an even distribution of radiation by implanting radon seeds into a yielding structure such as a bladder wall, and though many ingenious radon seed introducers have been devised, notably one in Edinburgh, areas of low dosage are often left in the implant and there is no satisfactory method of correcting it. With radio-active tantalum wire, however, the lesion can be undersewn, and a more accurate distribution obtained.[1]

* Based on a paper delivered at The South African Medical Congress, Port Elizabeth, June 1954.

After the suprapubic approach, a special 2-pronged introducer is attached to a Harris' boomerang needle and used to pull the wire through under the lesion in the superficial layer of bladder muscle. The wire is then looped at one end and attached to silk threads which are brought out through the urethra, thus allowing the wire to be removed at the end of the calculated time of dosage without re-opening the bladder. Tantalum wire is platinum-coated and therefore non-irritant. It has a half-life activity of 111 days and is usually of a strength of about 3-5 millicurie per cm. It emits gamma and beta rays, though most of the beta rays are absorbed by the platinum covering. A treatment of 6,000 r spread over 7 days is the usual dosage, the beta rays being discounted in the dosage calculation.

Radio-active gold seeds are now being used in some centres overseas instead of radon seeds, but there is little advantage in a country where both are available. In South Africa there is a disadvantage in using radio-active gold seeds because of the shorter half-life activity and consequently the greater difficulty of importing them from England. (The half-life activity of radio-active gold seeds is 2·8 days and that of radon 3·8 days.)

The advantages of radio-active gold seeds are that they can be accurately machined and can be loaded into a special gun (designed by the Cancer Hospital), which facilitates rapid implantation when a large number of seeds have to be used. The radon seed has a fish-tail end, which occasionally tends to cause the seeds to jam in the introducer.

The main use for isotopes in the treatment of bladder cancer is for intracavitary application where irradiation of the whole mucosal surface of the bladder is required. Two main methods are now in use according as the isotope is applied in the liquid or solid form. In most cases, a balloon containing the isotope is inserted into the bladder. Müller[2] originally used liquid radio-active cobalt, but the long half-life of over 5 years of this isotope involved the risk, if the balloon burst, of serious and long-continued contamination of patient, medical attendants and rooms. More recently, the Cancer

Hospital[3, 4] has evolved a technique using first radio-active sodium (half-life 14 hours) and later bromine (half-life 2·8 days) in a rubber balloon. The technique is to give a mucosal dose of 4,500 r in 4 days. After 48 hours the balloon is emptied and re-loaded with more active bromine. The disadvantages are the short half-life of radio-active sodium and radio-active bromine, the complicated apparatus, the difficulty of calculating the dosage, and the difficulty of loading the balloons. The use of liquid isotopes also has the disadvantage of achieving only a low-depth dose in the wall of the bladder.

RADIO-ACTIVE GOLD

Ellis at Oxford, who has not yet published his results, demonstrated to Dr. M. Weinbren last year a simple technique for irradiating the whole bladder mucosa for the treatment of benign papillomatosis, and we have since used this method in Johannesburg in a number of cases. A colloidal solution of radio-active gold (half-life activity 2·8 days) is injected into the bladder through a 'closed' catheter. The gold solution emits an intense beta irradiation with a very small amount of gamma rays. The solution is left in the bladder for the required time, depending on the initial activity of the gold used, and the effective dose required.

The dose delivered (both of beta and gamma rays) is calculated from the initial amount of radio-active gold injected into the bladder and from the diluted amount which is subsequently removed; the small quantity of gold retained in the bladder may be calculated from bladder washouts. The measurements of the gold are made with Geiger counters. The amount retained is usually negligible.

The patient generally has no difficulty in holding the solution in the bladder for the required time, if a suitable preparation is employed. No difficulties are encountered with contamination or exposure of personnel to radiation, if the correct apparatus and technique are used. Ellis, after 2-3 years' experience with this technique, has not seen any post-irradiational sequelae, and those patients that we have treated in this country by means of Ellis' technique have experienced no post-irradiational discomfort or cystitis, provided the bladder has not been previously irradiated by other methods such as the central radium tube.

Treatment with radio-active gold solution alone should be used only for benign papillomatosis and not for malignant lesions; for the latter it should be combined with some form of deeper penetrating irradiation such as from an intracavitary radio-active cobalt source. The beta irradiation from radio-active gold only penetrates effectively about 1 mm. in tissue, and therefore has no effect whatever on the deeper-lying infiltrations of malignant cells in the bladder musculature. The gamma rays from radio-active cobalt, as will be seen later, penetrate deeply into the bladder wall, and are able to eliminate these deeper-lying cells.

Though limited in its application to the treatment of benign papillomatosis of the bladder, ^{198}Au has a definite place in bladder-tumour therapy. The treatment is simple and well tolerated, entails no hospitalization except for the few hours during the administration of the solution, and does not cause any sequelae. A further possible use for gold solution is its administration a few days before a total cystectomy, to diminish the very real danger of wound contamination and implantation of seedling growths in the abdominal wall.

INTRACAVITARY RADIO-ACTIVE COBALT

When Wallace, Walton and Sinclair[3] published their technique and excellent results in the treatment of malignant papillomatosis by means of an intravesical bag containing radio-active bromine, the radiation therapy of this condition—previously most unsatisfactory—was established on a more satisfactory basis. Up to that time surgery in the form either of diathermy or cystectomy, external irradiation with high-voltage X-rays, or the radium catheter,[5, 6] were used for treatment, and all had their disadvantages.

For a single or a few benign papillomata diathermy coagulation is the treatment of choice, but the solitary malignant papilloma or multiple malignant papillomatosis presents a much more difficult problem. The solitary malignant papilloma is best treated by cystotomy and a radon-seed implantation after removal of the papilloma by diathermy; a maximum of 3 lesions can be treated in this way, provided they are separate and none is unduly extensive. When multiple seedling growths are present it is difficult to implant them all with radon and either cystectomy or some alternative form of radiation therapy must be used.

External irradiation with high-voltage X-ray units necessitates irradiation of the whole pelvic contents, with its associated discomfort due to bowel symptoms and skin reaction, in order to obtain such dose in depth to the bladder as will be effective on the tumours. Cystitis and bladder symptoms, with frequency and strangury, are also accentuated to varying degrees. Moreover, an adequate course of deep X-ray therapy will take up to 6 weeks or longer to deliver. As cystectomy is now not favoured by most urologists, the treatment of multiple malignant papillomata necessitates some form of irradiation.

Treatment for malignant papillomatosis is now directed at irradiating the entire bladder mucosa and potentially involved bladder wall with an even and biologically sufficient dose. Attempts were made to irradiate the mucosa evenly, using a 50-mg. radium tube mounted in a Foley's catheter.[5,6] This had obvious disadvantages; the balloon on the end of the Foley's catheter is seldom symmetrical when blown up, and the dose distribution from a radium tube is not even, being low at each end of the tube owing to the heavy platinum filtration at these points and cross filtration from the radium itself. This leads to a satisfactory dosage being delivered on the side walls of the bladder, but a considerably lower dosage at the vault and the base, which has resulted in recurrences in these areas. This method has also been used for localized malignant lesions; but it has given rise to severe reactions and late sequelae such as marked contraction of the bladder, and it is obviously contra-indicated on theoretical

grounds since it is unnecessary to irradiate the whole bladder mucosa for a localized lesion.

To avoid the use of liquid isotopes, which always carry the risk of a burst balloon, a catheter was designed,[7] employing a solid source of radio-active cobalt mounted in the centre of an intravesical balloon. This catheter was designed to be as fool-proof as possible because of the possibility of its being used in hospitals where the nursing staff are not experienced in its use. The solid radio-active cobalt source has many advantages over radium: It is small enough (2 × 2 mm.)

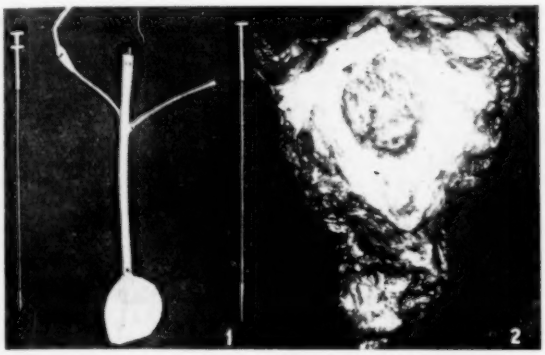

Fig. 1. Catheter with balloon, introducer and Cobalt container.
Fig. 2. Bladder removed *post mortem* after irradiation.

to be inserted into the end of an adjustable stilette (Fig. 1) which runs up the centre of the catheter, allowing the position of the cobalt to be moved inside the balloon if necessary; dose distribution is even all around the source, without areas of low dosage as with the radium catheter; and with radio-active cobalt the post-radiation cystitis is not as severe as with radium.

It was possible, in one case to remove at autopsy the bladder of a patient who had completed treatment for multiple papillary transitional-cell carcinomatosis of the bladder a month previously. He was a poor surgical risk, and died from septic bronchopneumonia. His bladder (Fig. 2) showed some remaining post-irradiation cystitis, and some scarred areas where growth had been present. A cross-section through the largest area of scarring is shown in Fig. 3. No malignant cells are shown on the mucosal surface, but deep in the muscle layer, some 7-8 mm. from the mucosal surface, is a clump of malignant cells undergoing intense post-irradiational degenerative changes, no obvious viable cells being present. The presence of these malignant cells—discovered by accident on section in a case that cystoscopically was a very superficial type of growth—shows the necessity of using for the treatment of malignant bladder lesions an isotope that has power to irradiate the deeper muscle layers of the bladder wall. This is the great advantage of a solid point-source of radiation such as ^{60}Co over liquid isotopes such as radio-active sodium or bromine.

Papillary tumours show up occasionally on pyelography, and such a case is shown in Fig. 4. The balloon

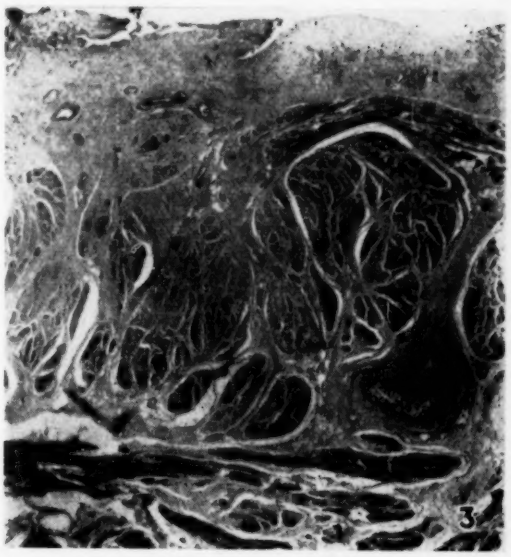

Fig. 3. Low-power cross-section of bladder wall. A clump of inactivated malignant cells are seen bottom right.

in position, showing the centrally placed source both in antero-posterior and lateral views, is well demonstrated (Figs. 5 and 6) and a post-irradiation pyelogram (Fig. 7) shows complete clearing of the filling defects. In this case, where the growth was mainly round the bladder base, the remainder of the bladder showing pre-malignant mucosal change, the ^{60}Co bead was adjusted slightly to lie nearer the base than the vault.

This latter method of treatment, and the use of instillations of radio-active gold solution, have been used for less than 3 years, and so no statistically-valid survival figures are available. After some initial disappointments when the apparatus used was not yet perfected and the selection of cases not as rigid as it is now, the results have been definitely encouraging. Some of the patients treated over the past 18-24 months remain free from recurrence, with surprisingly few post-irradiational symptoms and cystoscopically almost normal bladder mucosa. Cases showing the pre-malignant

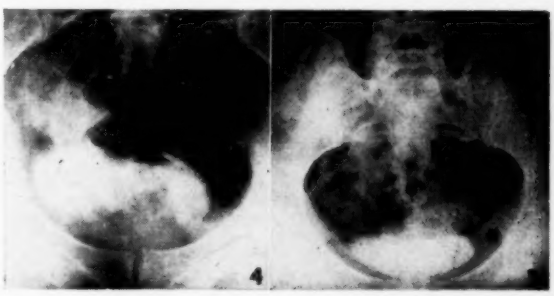

Fig. 4. Pyelogram showing papillary tumours before insertion of ^{60}Co.
Fig. 5. Post-irradiation pyelogram (same case as Fig. 4).

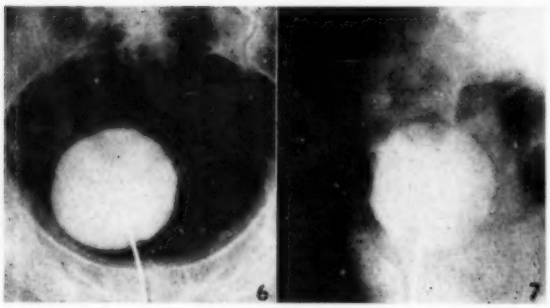

Fig. 6. Antero-posterior view with balloon and ^{60}Co in position (same case).
Fig. 7. Lateral view (same case).

change of the mucosa, have resolved with no development of growth. More cases must be treated before the final value of the methods can be assessed, but any method of treatment that allows a patient to keep his bladder or even postpones cystectomy for 2 years or more is well worth a prolonged trial.

ILLUSTRATIVE CASES

Case 1. M.G., male, aged 54, under the care of Mr. Clifford Thomson, suffered from multiple benign papillomatosis of the bladder for some years. Diathermy coagulation had controlled the spread for some time but eventually the whole bladder mucosa became involved.

On 28 July 1954, a radio-active gold solution was inserted into the bladder and an estimated dose of approximately 2,300 r (combined beta ray and gamma ray) delivered to the mucosal surface. No discomfort or difficulty in holding the solution was encountered. No post-irradiational symptoms and no increase in frequency followed this procedure. Cystoscopy on 8 September revealed some remaining congestion of the mucosa but no infection or crusting. One small cluster of 3 papillomata only remained, the remainder of the mucosal surface being free from growth.

Case 2. Mr. D.C.M., aged 71, under the care of Mr. I. Rogoff at the Vereeniging Hospital complained of haematuria of 2 years' duration. Cystoscopy showed a large flattish malignant papillary lesion on the right sidewall of the bladder, but bleeding was so profuse that an adequate view of the rest of the bladder was not obtained—though it appeared clear. Arrangements were made for a radium needle implant to the bladder, and the operation was performed on 20 July 1954. On the bladder being opened, a plaque of growth was seen on the right superior aspect of the bladder wall, fairly thick and infiltrating into muscle. An extensive papillary growth covering most of the right side wall of the bladder and extending onto the trigone was seen, together with extensive pre-malignant mucosal changes, and a small left-sided papilloma. It was decided that the growth was unsuitable for radium implantation, and a biopsy was taken and the bladder closed with a suprapubic tube in position. The biopsy showed an active papillary transitional-cell carcinoma of a high degree of malignancy. The following week (27 July) 40 millicuries of radio-active cobalt were inserted into the bladder in a balloon, *via* the suprapubic route left open at the previous operation. Radiography showed flattening of the balloon at the base of the bladder due to prostatic enlargement, but the position of the cobalt was otherwise satisfactory. A dose of approximately 5,200 r was delivered on the surface of the balloon over 96 hours, though the dose was low at the vault by 15% owing to the flattening at the base.

On discharge from hospital a fortnight later the patient was pain-free, with no haematuria. He remained well and free from blood in the urine for 6 months, when he complained of occasional bouts of haematuria of a fortnight's duration. Cystoscopy on 13 January 1955 showed that the bladder was free of growth except for an area at the vault, which showed active papillary growth. It is interesting to note that this area corresponded to the thick plaque of growth seen at the original operation, and which also was in the area of bladder wall that received low dosage. This area was well treated with diathermy and the patient discharged. He remains well to date, with no dysuria and only slight frequency.

Case 3. Mr. L.J.R., under the care of Mr. I. Widrich, was first seen at Krugersdorp Hospital on 27 October 1952 complaining of profuse haematuria off and on for the past few years. He was also complaining of marked frequency, dysuria and loss of weight. Cystoscopy on the same date showed a large, fleshy, broad-based ulcerating tumour filling the right half of his bladder. Bimanual examination revealed the bladder to be mobile and no extra-vesical infiltration was felt. Intravenous pyleography showed a normal right kidney and ureter but a marked right-sided hydronephrosis and hydro-ureter. There was a large filling defect on the right side of the bladder.

Cystotomy and radium implantation was performed on 13 October 1952 by Mr. I. Widrich and Dr. M. Weinbren. Cystoscopy findings were confirmed and a large tumour without a pedicle was destroyed with diathermy. Radium was then implanted into the base of the tumour, 6 2-mg. needles and 10 1-mg. needles being used.

Dr. J. Gluckman reported that the tumour on section showed a transitional-celled papillary carcinoma of Grade II-III malignancy. The cells showed marked pleomorphism and anisonucleosis, with marked disturbance in cell polarity. Few mitoses were present but there was marked stromal invasion.

The patient made an uninterrupted recovery from the operation, and for 16 months remained free of symptoms. He had no bleeding or frequency and put on weight. In July 1954 symptoms returned, with haematuria and dysuria. He was unwilling to have further treatments, but cystoscopy was performed on 20 November 1954, when multiple flat papillomata around the scar of the radium insertion were seen. Bleeding was profuse from these areas and also from inside his scar.

On 26 January 1955 a radio-active gold insertion was performed. A total of approximately 3,000 r beta and gamma rays was delivered to the bladder mucosa, and on 21 March the patient returned for cystoscopy. He had gained weight and had had no further bleeding, and only mild night frequency and dysuria. His anaemia was improving and he was back at work, having previously been bed-ridden. Cystoscopy showed a bladder of good capacity with no bleeding on distention. A few small sloughs around the original radium scar were present but no papillomata were visible. The remaining bladder mucosa was normal.

This case, though the time elapsing since the gold therapy is short, shows several interesting points. Palliation of a high order has been achieved with minimal disturbance to the patient, and with prospects of a considerable period free from symptoms judging from the last cystoscopic appearances. Two contra-indications to the use of radio-active gold were ignored, viz. the use after previous heavy local irradiation and the use in a malignant condition of the bladder. However, as the patient was unwilling to submit to a total cystectomy and bilateral ureteric transplant, it was thought worth while to try the effect of a radio-active gold instillation—so far with a gratifying result.

SUMMARY

1. The value of the various radio-active isotopes in current use in the treatment of bladder tumours is discussed. Special reference is made to the intravesical application of radio-active gold and radio-active cobalt, with illustrative case reports in each case.

2. Although not many cases have been treated, either abroad or by us, and a long enough period has not elapsed for a full assessment of the method, it is considered that the results so far obtained are so encouraging that persistence with these methods is justified.

3. The treatment of benign papillomata with radio-active gold is particularly satisfactory because of the

ease with which it is administered and lack of post-irradiation symptoms.

4. It is considered that radio-active cobalt has many advantages as a central source of radiation in a balloon as compared with a radium source because of the compactness of the cobalt, which is only a small bead, the isodose distribution, and the ease with which its position can be altered under radiographic control.

I am indebted to Mr. Clifford Thomson, Dr. I. Rogoff and Dr. I. Widrich for permission to publish details of cases 1, 2 and 3 respectively, and to Dr. J. Gluckman for the pathological reports on cases 2 and 3. I am also indebted to Mr. E. Lipworth for the interest he has taken in this work; his cases have been treated too recently for publication. My thanks are due to Dr. M. Weinbren for his help and encouragement in the preparation of this article and for permission to publish details of his cases in Johannesburg. I am grateful to the staff of the Royal Cancer Hospital, London, for the information they kindly placed at my disposal.

Addendum. Since this article was written, Ellis (1955)[8] has published details of the technique which he has developed at Oxford for the treatment of benign papillomatosis of the bladder with radio-active gold and which we follow closely in Johannesburg.

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INJURIES - THE MEDICAL FACTS : BESERINGS - DIE MEDIESE FEITE*

1. *The toll of injury.* Besides 1,495 people who were killed and nearly 21,000 permanently disabled, many thousands more suffered pain, loss of earnings and temporary disablement as a result of occupational injuries in 1952.

2. *The medical bill.* Cases of permanent disablement accounted for 2/5ths and fatal cases for about 1/5th of the total cost of more than £1 million spent by the Accident Fund and other carriers of accident risks to provide medical aid to the victims of occupational accidents in 1952.

3. *The brunt of injuries.* The arm and hand suffered nearly half (74,642) of the total number of injuries. Next in order are; the lower limb with 46,594 cases, the head, face and neck with 30,413 cases, the eye with 21,831 cases and the trunk with 11,713 cases. These facts afford a guide to the parts of the body most at risk.

4. *The value of first-aid.* It is best to prevent injuries, but the next best is to lessen their train of ill-effects. First-aid, when promptly and efficiently given, is of the greatest value in lessening pain, disability and loss of working time and earnings.

5. *What injuries should receive first-aid?* All injuries, whether minor or serious, should receive first-aid from a qualified first-aider: many apparently trivial injuries give rise to disabling complications when neglected.

6. *What are the most common injuries at work?* Wounds, eye injuries, strains, fractures and skin lesions are the most common injuries. First-aiders in industry should, therefore, be well equipped to deal with these and, in particular, injuries to the hand and eyes.

7. *What to do when an injury happens.* Report an injury at once so that the details can be recorded properly and immediately. The completed accident and medical forms must be sent *promptly* to the Workmen's Compensation Commissioner by employers so as to prevent troublesome delays and difficulties in handling claims.

N.B.—Early completion of medical forms greatly expedites the payment of compensation and the settlement of medical accounts.

8. *Who should treat an injury?* After receiving skilled first-aid, the injured workman should consult a doctor at once if the condition needs medical treatment. He must *not* treat himself nor allow anyone else other than a registered medical practitioner to do so, nor delay in seeking medical aid, when necessary, since considerable

* Supplied by the Office of the Workmen's Compensation Commissioner.

1. *Die veelvuldigheid van beserings.* Behalwe vir 1,495 persone wat gedood is en nog byna 21,000 wat blywende arbeidsongeskiktheid opgedoen het, moes duisende ander pyn verduur of het hulle verlies aan lone gely of was hulle arbeidsongeskik as gevolg van bedryfsbeserings gedurende 1952.

2. *Die mediese rekening.* Gevalle van blywende arbeidsongeskiktheid was verantwoordelik vir 2/5 des en noodlottige ongevalle vir 1/5de van die totale koste van meer as £1 miljoen wat die Ongevallefonds en die ander draers van ongevalle-risiko gedurende 1952 moes aangaan om mediese hulp aan die slagoffers van bedryfsongevalle te verskaf.

3. *Watter liggaamsdele meestal beseer word?* Ongeveer die helfte (74,642) van alle beserings was aan die arm of die hand. Dan volg beserings aan die onderbeen met 46,584 gevalle, dan die kop, gesig en nek met 30,413 gevalle, die oog met 21,831 gevalle en die romp van die liggaam met 11,713 gevalle. Hierdie feite toon watter liggaamsdele die meeste aan beserings blootgestel is.

4. *Die waarde van eerstehulp.* Dit is die allerbeste om beserings te voorkom, maar die tweede beste is om die ongunstige nasleep daarvan sover moontlik te beperk. Eerstehulp, wanneer dit dadelik en doeltreffend toegepas word, is van die grootste belang om pyn, ongeskiktheid en verlies aan werkstyd en lone te verminder.

5. *Watter beserings behoort eerstehulp-behandeling te ontvang?* Alle beserings, of dit nou gering of ernstig is, behoort eerstehulpbehandeling van 'n opgeleide eerstehulp-beampte te ontvang. Dikwels is geringe beserings die oorsaak van ongeskiktheidkomplikasies indien dit verwaarloos word.

6. *Wat is die mees algemene soort beserings by die werk?* Wonde, oogbeserings, verrekkings, beenbreuke en velkwetsure is die mees algemene soort beserings. Eerstehulp-beamptes in die nywerheid behoort gevolglik goed toegerus te wees om met hierdie soort beserings te handel, veral beserings aan die hande en oë.

7. *Wat om te doen as 'n besering plaasvind.* Meld 'n besering dadelik aan sodat besonderhede behoorlik te boek gestel kan word. Die voltooide ongevalle- en mediese vorms moet so gou doenlik deur werkgewers aan die Ongevallekommissaris gestuur word ten einde lastige vertragings en moeilikhede in verband met die behandeling van eise te voorkom.

L.W.—Spoedige voltooiing van mediese vorms werk ook die spoedige betaling van skadeloosstelling en mediese rekenings in die hand.

8. *Wie moet beserings behandel?* Indien die toestand mediese behandeling vereis, moet 'n geneesheer dadelik nadat eerstehulpbehandeling toegepas is, geraadpleeg word. Die beseerde werker moet *nie* homself behandel nie of iemand anders behalwe 'n geregistreerde mediese praktisyn toelaat om dit te doen nie. Hy moet ook nie versuim om mediese hulp te verkry nie, waar dit nodig is, daar verwaarlosing of verkeerde behandeling ernstige gevolge kan hê. Geringe beserings veroorsaak dikwels groot

* Ingedien deur die Kantoor van die Ongevallekommissaris.

harm can be done by wrong treatment or neglect. Slight injuries often cause most difficulties in the administration of the Workmen's Compensation Act because they are frequently not reported to a responsible person and do not receive first-aid or medical attention. If complications subsequently arise, lack of supporting evidence may lead to rejection of the claim.

9. *How to lessen the costs of injury.* The injured workman does not receive full wages while off work. So the longer he is absent the greater is his loss of earnings, the less he produces and the higher the costs of compensation. For example: a workman earning £15 per week would receive only about £5 15s. per week while off work i.e. a weekly loss of wages of £9 5s.

10. *Why unnecessary absence from work harms the patient.* Unnecessarily prolonging the time off work is harmful to the patient because it often causes neuroses, loss of working skill and morale and incomplete and delayed recovery. When the patient co-operates fully with his doctor, the treatment given will be more effective and recovery speedier and more complete.

N.B.—Other industrial health literature is obtainable, free of charge, from the Workmen's Compensation Commissioner, P.O. Box 955, Pretoria.

moeilikhede in die administrasie van die Ongevallewet omdat hulle dikwels nie aan 'n verantwoordelike persoon gerapporteer word nie en ook nie eerstehulp- of mediese behandeling ontvang nie. Indien komplikasies later ontwikkel, wat nie deur getuienis ondersteun is nie, kan dit tot die afwysing van die eis lei.

9. *Hoe om die koste van beserings te verminder.* Die beseerde werksman ontvang nie sy volle loon terwyl hy van sy werk afwesig is nie. Hoe langer hy dus afwesig is, hoe groter is sy verlies van lone, hoe minder produseer hy en hoe hoër die koste van skadeloosstelling. So, byvoorbeeld, sal 'n werksman wat £15 per week verdien slegs £5 15s. per week kry terwyl hy afwesig van werk is, d.w.s. 'n weeklikse verlies van £9 5s.

10. *Hoekom onnodige afwesigheid van werk die pasiënt benadeel.* Die onnodige verlenging van die tydperk van afwesigheid is nadelig vir die pasiënt omdat dit dikwels neurose, afname van werksbedrewenheid en moraal, en onvolledige en vertraagde herstel in die hand werk. As die pasiënt ten volle met sy geneesheer saamwerk, sal die behandeling wat hy ontvang doeltreffender wees en sal sy herstel spoediger en meer volledig wees.

L.W.—Ander lektuur i.v.m. bedryfsgesondheid is kosteloos verkrygbaar van die Ongevallekommissaris, Posbus 952, Pretoria.

IN MEMORIAM

JOHN FEARBY CAMPBELL HASLAM, *C.M.G.*, *M.C.*, F.R.C.P., D.P.H. (EDIN.)

Dr. J. F. C. Haslam, formerly Director of Medical Services, Northern Rhodesia, died in Cape Town on 2 September 1955. The funeral service took place at Maitland Crematorium on 6 September and was attended by the High Commissioner for the Federation of Rhodesia and Nyasaland and many old Northern Rhodesians who have settled in the Cape.

The late Dr. J. F. C. Haslam, *C. M. G., M. C.*
Photo Northern Rhodesia Information Dept.

The Northern Rhodesia Government Information Department states: Dr. Haslam was born in 1888 and educated at Dollar Academy and Edinburgh University. He held the following positions: 1912-14 Resident Hospital appointments in Edinburgh; 1914-19 R.A.M.C.; 1919-21 Assistant to Dr. Harvey Littlejohn, Professor of Medical Jurisprudence, Edinburgh University; 1921-25 Government Medical Officer of Health, British Guiana; 1925-30 Assistant Director, Bureau of Hygiene and Tropical Diseases, London; 1930-32 Physician and Bacteriologist, 'Shell' Group of Oil Companies, Venezuela; 1933-35 Chief Medical Officer, Barbados; 1935-47 Director of Medical Services, Northern Rhodesia; 1947-50 Chairman, Silicosis Medical Bureau, Northern Rhodesia; 1950-52 Silicosis Commissioner, Northern Rhodesia, retired June 1952. In December 1953 Dr. Haslam became Special Nominated Member for African Interests in the Federal Assembly of Rhodesia and Nyasaland, and Chairman of the African Affairs Board. He resigned from the Federal Parliament in 1954 on grounds of ill-health.

In 1921 he married his cousin, Edith, daughter of the late Rev. Neil Kennedy McKenzie, M.A.

The following telegram was sent to Dr. Haslam's widow by the Governor of Northern Rhodesia, Sir Arthur Benson, K.C.M.G.: 'On my own behalf and on behalf of the Government I send you our deepest sympathy. Your husband's great work for all the people of this Territory both during his service and since his retirement will always be remembered here. His many friends in Northern Rhodesia mourn him with you'.

Dr. P. B. Robinson, who recently retired from the post of Director of Medical Services, in which he succeeded Dr. Haslam, broadcast a message from Lusaka, from which the following is extracted: 'Dr. Haslam planned the development of the Health Department from small beginnings, and it is to his brilliant brain that the country owes tribute for the efficient machine which it is today. He was a great friend to the Africans as to the other races in the country and the African must always remember that the Health Service available to him, which has so greatly expanded in the last 20 years, is due to Dr. Haslam's forethought. When Dr. Haslam left Medical Headquarters he took charge of the Silicosis Medical Bureau at Kitwe and moulded the Bureau into one which is recognized as second to none in the world. With his passing not only has Northern Rhodesia and the whole of Africa lost one of their best friends, but so have I. I cannot say how much I owe to his leadership and inspiration. I would say of Johnnie Haslam: 'His life was gentle, and the elements so mixed in him that nature might stand up and say to all the world—this was a man'.

Dr. F. R. Luke, of Cape Town writes: With the passing of 'Johnnie' Haslam there has gone from our midst one of those rare spirits who appear seldom in a generation; for he had everything—all those qualities of heart and brain which make the complete man. Left an orphan at the age of 10 he was brought up by his grandparents, Major General and Mrs. Grant. Brains and ability he had to an exceptional degree, a steadfast courage which proved itself again and again on the field of battle and elsewhere, and great tenacity of purpose with the ability to get his own way without conflict. Above all these he had the faculty of making and keeping friends to a really extraordinary degree. A great part of his charm lay in the fact that he carried his honours and distinctions lightly. Never was there a less pompous chief.

I had the privilege of his friendship from student days in Edinburgh. We 'digged' together with the admirable Miss Stewart opposite the Royal Infirmary gate; we played together, worked together, went walking tours together and even psychoanalyzed each other. We did not graduate together only because an attack of diphtheria laid him low at examination time. For many years we lost sight of each other, but our relations were resumed more than 40 years later as if we had parted the day before. My wife and I will never forget the warmth of our reception by him and his charming wife at New Lusaka.

Of his academic distinction it is unnecessary to speak; he was an acknowledged authority and he edited *Recent Advances in*

Preventive Medicine for the Recent Advance series. Of his knowledge of silicosis it is sufficient to say that on his retirement as Director he was at once appointed Chairman of the Silicosis Medical Bureau. Of his interest in human affairs beyond the mere science of medicine there can be no more signal evidence than his appointment as Government nominee to represent Native interests in the Federal Parliament of Rhodesia and Nyasaland and as Chairman of its Standing Committee, the African Affairs Board. He won the *M.C.* and was mentioned in despatches for his service as Regimental M.O. with the Royal Muinster Fusiliers in the first world war, when he served in Serbia, Salonica, Egypt, Palestine and France.

A man is lucky if in the course of his earthly pilgrimage he meets with one or two friends to whom he would be prepared to entrust everything he holds dear—his life and even his honour. The writer is fortunate in having found two such friends in Stanley Silberbauer and 'Johnnie' Haslam. It was a privilege to be able to care for 'Johnnie' during his last days and to witness the deep devotion of his wife, to whom in her grief all our sympathy must go out.

CONGRESS NEWSLETTER : KONGRESNUUSBRIEF

Popular Lecture—Sunday 16 October, 1955. The Organising Committee of the 40th S.A. Medical Congress to be held in Pretoria from 17 to 22 October, 1955, invites all members of the Medical Profession to attend the Popular Lecture to be held in the City Hall, Pretoria, at 8.30 p.m. on Sunday 16 October, 1955.

Mr. H. J. B. Atkins, Director of the Surgical Unit, Guy's Hospital, London, will give an address on Cancer entitled 'Fears may be Liars'.

* * *

Oud-Studente Nederland. Die program van die Mediese Kongres in Pretoria laat die Dinsdagaand 18 Oktober a.s. vry. Daardie aand word 'n byeenkoms met maaltyd in die Constantia Club, Paul Krugerstraat 259, Pretoria, gehou vir studente wat in Nederland studeer het, Afrikaners of Nederlanders, oud of jong, vrou of man en met hulle eggenoot(note). Oud-studente van ander as die mediese fakulteite sal ook deelneem.

Aan alle bekende adresse word 'n rondskrywe met meer besonderhede toegestuur. Belangstellendes, wat hierdie sirkulêre nie voor die einde van Augustus ontvang het nie, kan naam en adres opgee by die Reëlingskomitee Oud Studente Nederland, Posbus 417, Pretoria.

Openbare Lesing—Sondag 16 Oktober 1955. Die Organiserende Komitee van die 40ste Mediese Kongres, wat in Pretoria vanaf 17 tot 22 Oktober 1955, gehou word, nooi alle lede van die mediese professie vriendelik uit om die Openbare Lesing op Sondagaand, die 16 Oktober 1955, om 8.30 in die Stadsaal, Pretoria, by te woon.

Mnr. H. J. B. Atkins, direkteur van die Snykunde-eenheid, Guys-Hospitaal, Londen, sal 'n toespraak lewer oor Kanker. Die opskrif van sy toespraak is ‚Fears may be Liars'.

* * *

Witwatersrand Alumni Luncheon. If a sufficient number of old Witwatersrand Medical Students signify their intention of coming, it is proposed to hold a luncheon for alumni on Thursday the 20 October, from 1-2 p.m. As it is important to know the number of people who intend coming for reservation purposes, it would be appreciated if all interested would get in touch with Dr. E. Fasser, 201 Medical Centre, Pretoria (Tel. Pretoria 3-9753) as soon as possible.

PASSING EVENTS : IN DIE VERBYGAAN

Union Department of Health Bulletin. Report for the 7 days ended 8 September 1955.

Plague, Cape Province: No further cases have been reported from the Williston Divisional Council Area since the notification of 11 August 1955. This area is now regarded as free from infection.

Smallpox: Nil.

Typhus Fever, Cape Province: No further cases have been reported from the Somerset East and Mossel Bay Divisional Council Areas since the notification of 11 August 1955. These areas may now be regarded as free from infection.

Epidemic Diseases in Other Countries:

Plague: Nil.

Cholera in Calcutta (India); Chalna, Dacca (Pakistan).

Smallpox in Rangoon (Burma); Phnom-Penh (Cambodia); Allahabad, Bombay, Kanpur, Tellicherry (India); Dacca, Karachi, Lahore (Pakistan); Nhatrang, Saigon-Cholon (Viêt-Nam).

Typhus Fever in Baghdad (Iraq); Alexandria, Cairo (Egypt).

Errata. In die Afrikaanse hoofartikel *Aangebore Nierbuis-Afwykings* (10 September 1955, bladsy 856) behoort die betrokke sin as volg te lees: ‚Aminosurie, sowel as 'n oormatige uitskeiding van koper, kom voor by *Kinnear Wilson* se siekte . . .' (verbeterde woorde in kursiewe druk).

* * *

Reduced Rates of Customs Duty on INH and PAS. In Government Notice No. 1775 of 9 September 1955 the Department of Finance notifies for public information amendments to the Customs tariff, the effect of which is that from the date mentioned the following preparations will be admitted free of Customs duty in terms of item 224 (*a*) of the Customs tariff: Isonicotinic acid hydrazide, and its salts and derivatives, Para-aminosalicylic acid, and its salts and derivatives, Combinations of these drugs, and combinations of these drugs with other substances.

ASSOCIATION NEWS : VERENIGINGSNUUS

SPOORWEGGENEESHEREGROEP—ALGEMENE JAARVERGADERING

Die volgende Algemene Jaarvergadering van die Spoorweggeneesheregroep sal gehou word om 2 n.m. klokslag op Maandag, 17 Oktober 1955, in Kamer 53, Nuwe Kunsgebou, Universiteit Pretoria.

RAILWAY MEDICAL OFFICERS GROUP—ANNUAL GENERAL MEETING

The next Annual General Meeting of the Railway Medical Officers Group will be held at Room 53, New Arts Block, University of Pretoria, on Monday, 17 October at 2 p.m. sharp.

BOOK REVIEWS : BOEKRESENSIES

CLINICAL RESPIRATORY PHYSIOLOGY

The Lung. Clinical Physiology and Pulmonary Function Tests (*Based on the* 1954 *Beaumont Lecture*). By Julius H. Comroe, Jr., M.D., *et al.* Pp. 219 + viii, with 57 illustrations. $5.50. Chicago: The Year Book Publishers Inc. 1955.

Contents: 1. Lung Volumes. 2. Pulmonary Ventilation. 3. The Pulmonary Circulation and Ventilation/Blood Flow Ratios. 4. Diffusion. 5. Arterial Oxygen. 6. Mechanics of Breathing. 7. Clinical Applications of Pulmonary Function Tests. Appendix. Index.

This lucidly written and abundantly illustrated little volume should do much to overcome the current lack of attention suffered

by respiratory physiology. The profusion of pulmonary function tests is presented from a clinical viewpoint; selected case-reports indicate the diagnostic value of quantitative studies.

The authors would have done greater service by indicating more clearly which of the twenty-odd investigations one would carry out in a particular case; in their clinic the same battery of tests appears to be used on every occasion—surely time-consuming for the physician and harrowing for the patient.

They have, one feels, justified their plea for the more frequent use of simple spirometry in diagnosis and especially in assessing the results of therapy; the technique is easily performed and most informative.

There is a good account of the chemical regulation of respiration, including a reference to the risk of depressing breathing to the point of carbon-dioxide retention and acidosis, when administering pure oxygen for diffuse lung disease.

Despite its minor flaws, this book can be recommended warmly, to thoracic physicians and surgeons alike.

B.L.

SUGAR AND DENTAL CARIES

Medical Research Council Special Report Series No. 288. *The Effect of Sugar Supplements on Dental Caries in Children.* By J. D. King, May Mellanby, H. H. Stones and H. N. Green. Pp. 55 + viii. 4s. London: Her Majesty's Stationery Office. 1955.

Contents: 1. Introduction. 2. Plan of Investigation. 3. General Notes on the Three Studies. 4. Methods and Results of the Individual Studies. 5. Discussion and Conclusions. Appendices. References.

This is a report of three trials of the effect of extra sugar on the incidence of dental caries in children. The London group of children were aged from 2 to 4 years and the Sheffield and Liverpool groups from 4 to 14. The children were in institutions and were observed over periods varying from 1 to 2 years. The basal diet was deemed satisfactory in regard to protein, minerals, vitamins and calories. Twenty-two ounces of sugar per week was given to the older children in addition to the basal diet, making the total intake about 37 oz.; the younger London group could not take so much, and so the sugar of the basal diet was reduced to 11 oz. per week and the experimental group got another 11 oz. Including the controls 762 children were studied.

The result was clear cut, namely that great differences in the sugar content of the diets of children in institutions had no effect on the initiation or spread of caries in periods of 1 to 2 years.

But, before going jubilantly to the tuck shop, please note that the extra sugar was added to the regular meals and that the M.R.C. is not prepared to guarantee that indiscriminate sweet-eating will be equally innocuous.

G.C.L.

CORRESPONDENCE : BRIEWERUBRIEK

THE POLIO VACCINE : A DOCTOR'S DILEMMA

To the Editor: The tempest of publicity which has accompanied the trials and release of polio vaccine (not least in South Africa) has bred in me, as in many of my colleagues, a feeling of scepticism born of similar experiences in the past. As medical men we have long since become inured to this new form of scientific discipline which the popular press and radio have imposed upon us. The survey by Dr. Turner,[1] though belated, has therefore come as a welcome breeze. However, there are still some important questions which remain unanswered.

According to Turner, Salk found that 'with a culture of the virus with a final titre of 10^6 in a medium of pH 7.0 treated with a 1 : 4,000 formalin solution under constant conditions, there was a steady loss of infectivity with virtually no loss of antigenicity'. The destruction of the virus was shown to proceed in a linear fashion so that it could be calculated, by extrapolation of the line of regression, that at the end of 9 days there should be only one living virus per million million ml. of the medium. At this stage, the risk of transmission should, therefore, be practically nil. Salk also showed that 'chemical treatment for the inactivation of the virus particles' (with *weak* formalin solution) 'does not reduce to a measurable extent the antigenicity of the vaccine *unless overtreatment is extended for a period which is* 5 *times longer than that required to destroy infectivity*' (italics inserted), i.e. presumably 45 days.

As is well known, the destructive effect of a chemical is seldom directly proportional to its concentration. Thus, e.g., a weak solution of acid may have no demonstrable effect on human tissue even after prolonged immersion, but momentary contact with the same acid in double or treble concentration may cause severe destruction. Even if we make the questionable assumption that, in the case of formalin, the destruction of antigenicity can be measured by the product of the concentration and the time of exposure, the South African vaccine appears to have been subjected to between 3 and 4 times the *maximum* treatment computed by Salk as necessary for inactivation without loss of antigenicity. If Salk's findings are correct, the South African vaccine has been grossly over-treated and its antigenicity correspondingly impaired. If he is incorrect, I feel we are entitled to know the 'experimental evidence' which, Turner asserts, 'indicated that the increased exposure to a double concentration of formalin would not significantly alter the antigenicity of the vaccine'.

The Americans have apparently been content merely to tighten up their safety tests without modifying their original process, despite the fact that their vaccine contains the virulent Mahoney strain. The South African vaccine has been treated with a 1 : 2,000 concentration of formalin, not only for the initial incubation for 10 days at 37°C, but also for an additional 2 to 3 months at ice-box temperature.

The objective index of antigenicity is the production of a measurable antibody response in the unimmunized subject at risk, i.e. the human child, not the experimental animal. Thus, for example, anti-M agglutinin is readily produced in rabbits following injection of human M+ blood but practically never follows its transfusion to an M− human recipient. Again, serological evidence of previous infection does not necessarily connote practical immunity. Nevertheless, let it be accepted at this stage that in the case of polio vaccination the appearance of antibodies is an encouraging indication in that direction. Following events as they have unfolded themselves in lay press reports, it would appear that only 12 children were inoculated in the trials with the South African vaccine. Having regard to the sequence of the relative announcements and in the light of Dr. Turner's reference to these trials, it would now appear that these children may have received injections from earlier batches of vaccine, which were treated with a lower concentration of formalin for a lesser time. As I recall, the South African Poliomyelitis Research Foundation was ready to release the vaccine straight after the publication of the Francis Report. If this is so, serological data regarding these children would not necessarily reflect the antigenicity of the vaccine presently being released. Nevertheless, it is important to know whether the above surmise is correct and also whether, in these few children at least, there were no antibodies present before inoculation but following injection there was a significant antibody response. This, and similar essential information, is lacking from Dr. Turner's review.

Finally, there is the question of possible sensitization to substances other than the killed virus in the vaccine, e.g. penicillin, streptomycin and monkey kidney tissue. Since the Rh factor is contained exclusively in the red cells, the hazard of Rh sensitization can reasonably be discounted; the potential risks of sensitization to kidney tissue are not so easily dispelled (despite the chloroform treatment) as no one knows at present what the long-term effects of such stimulation may be. An even more serious consideration, perhaps, is the potential hazard from mass inoculation with penicillin. The *immediate* risk of sensitivity reactions in children receiving the vaccine is probably small for two obvious reasons: (1) Only a small proportion of children has ever previously received penicillin; and (2) the amount of penicillin contained in each dose of vaccine is probably so small as to cause only a mild local reaction in previously sensitized subjects.

However, the possible *long-term* effects of sensitization are clearly a matter of concern. One has only to read the current literature to appreciate the growing magnitude of the danger of anaphylaxis following previous penicillin sensitization, even though its use is presently restricted to the treatment of diseases. Numerous and severe admonitions have recently been issued in the most responsible organs of medical opinion against its indiscriminate use even for therapeutic purposes. Yet the potential hazard from mass immunization of an entire generation of individuals with a vaccine containing penicillin, administered at an age when the human organism is particularly responsive to antigenic stimuli of all kinds, appears to have been minimized or ignored. Despite recent advances in antibiotics, penicillin remains the sheet-anchor of treatment in a large variety of diseases throughout life. The benefits which it has conferred on mankind are as incalculable as is the tragedy which would result if widespread sensitization were to endanger its future use.

Parenteral injection is the most certain method of inducing sensitization in allergic individuals, and it can be evoked with minimal amounts of antigenic substances. One is therefore entitled to speculate on the possibility that there may even be other sources of potential danger. One has only to recall that permanent sensitization to the Rh factor may result from tiny quantities of foetal blood escaping across the placental barrier into the mother's circulation during pregnancy. This is an inescapable hazard, and occurs in about 1 in 40 Rh-negative women. But in the days before the discovery of the Rh factor, tens of thousands of Rh negative persons throughout the world were unwittingly placed at risk by blood transfusions and intramuscular injections of blood. Of these, not less than 50% were permanently sensitized.

In the case of females, many of whom were sensitized early in life, there remains a legacy of repeated stillbirths and neonatal deaths and a host of spastic idiots to testify to the complications which may result from the indiscriminate injection of blood without regard to this factor—complications which were never dreamt of at the time and which remained unrecognized for many years. At least there is this to be said in favour of blood transfusion (as distinct from the useless intramuscular injections) prior to the enlightenment which followed the discovery of the numerous antigenic blood-group factors: the benefits in the individual emergencies far outweighed the risks, immediate and remote. In the case of polio, the risk of paralytic polio is known to be approximately 1 : 1,000 of the population even though all, or practically all, children contract the infection.

Experiments with the production of a live, attenuated vaccine are already far advanced and the perfection of a safe product can reasonably be expected in the near future. Oral administration will eliminate all the various risks inseparable from injections of killed virus vaccines as presently prepared. To this must be added the American evidence that the immunity conferred by vaccination with the killed virus is problematical and, at best, partial.

The foregoing are the reasons which deter me from having my own three small children vaccinated at present. As a general practitioner, I obviously have the same professional responsibility to my patients. And my advice to them has been to wait a while longer and

> '. . . . rather bear those ills we have
> Than fly to others that we know not of'.

M. Shapiro

5 Sasbank Buildings
66 Market Street
Johannesburg
12 September 1955

1. Turner, R. (1955): S. Afr. Med. J., **29**, 833.

A REPLY BY DR. GEAR

To the Editor: I am grateful for this early opportunity of discussing the queries raised in Dr. Maurice Shapiro's letter of 12 September referring to 'The Polio Vaccine : a Doctor's Dilemma'. One can sympathize with Dr. Shapiro and with all medical practitioners who share his dilemma. Indeed all concerned with the poliomyelitis vaccine have been uncertain of the situation. No one in South Africa is to blame for this state of mind for it arose out of incidents in the United States where, since the general release of vaccine in April of this year, about 80 cases of paralytic poliomyelitis probably attributable to its use have been reported.

Only recently has the situation become clearer, and only recently has it been possible for the Advisory Committee of Experts, after a consideration of the relevant information from those concerned with similar problems elsewhere in the world, to come to a decision as to the use of the vaccine prepared in South Africa. This decision was communicated to the public and the medical profession by the Minister of Health through the quickest channels—the daily Press and the radio news service.

A review of the development of the present situation, by Dr. R. Turner, was then published in the *South African Medical Journal* for the information of the medical profession. To prepare and publish such a comprehensive review in the short time taken was a notable achievement, but in the interval between the Minister's statement and its appearance there was naturally some confusion in the minds of many medical practitioners, and in view of conflicting reports from other sources this has not altogether been resolved.

Dr. Turner, in his brief account of the South African vaccine, was not able to dispel some of the doubts perplexing Dr. Shapiro's mind. We appreciate Dr. Shapiro's concern and interest in our vaccine and would be glad to show him, or any other medical practitioner, round our laboratories. Such a visit would help him more than any correspondence to understand and appreciate the principles and practice of the preparation of virus vaccines.

It should be made clear that in preparing our vaccine we have been largely guided by the work done in North America. We have been particularly fortunate in having the advice of Dr. Thomas Weller and Dr. Jonas Salk of the United States, and of Dr. Sven Gard of Sweden. Our methods of producing the vaccine have been based on those worked out by Dr. Salk and his associates. Some modifications have been made to ensure greater safety. In developing a vaccine one may aim at the maximum amount of antigenicity compatible with safety, or at the maximum safety compatible with antigenicity. It was decided to follow the second of these two ways.

Early in our studies it became apparent that it was desirable to increase the time of exposure to formalin. This decision was taken before the incidents in the United States occurred. Subsequent to their occurrence and on the recommendation of the Advisory Committee this longer exposure to 1 : 4,000 formalin under refrigeration is now followed by an exposure to 1 : 2,000 formalin for 3 days only. Vaccine suspensions subjected to this treatment retain their antigenicity.

Before any batch of vaccine is released for issue it must be shown to conform with certain minimum requirements of safety and potency. All that is at present claimed for the vaccine issued from the Poliomyelitis Research Foundation is that it conforms with these standards, which are based on the latest regulations of the United States Public Health Service. These were drawn up subsequent to and in the light of the accidents following the use of certain batches of vaccine in the United States.

It is known that vaccines conforming with these standards are effective in stimulating the production of poliovirus antibodies in the majority of children inoculated with them. The appearance of antibodies following vaccination is an indication that some degree of immunity has been conferred on the individual concerned. The children inoculated with our vaccine who did not have antibodies before developed them after vaccination.

We have long been aware of the theoretical dangers inherent in poliomyelitis vaccine prepared from monkey kidney tissue cultures and containing penicillin and streptomycin, and have considered how to eliminate them. As a result of studies carried out in collaboration with Dr. Polsen, a member of Professor van den Ende's Virus Unit in Cape Town, it appears that this can be done. However, it has not yet been shown that kidney damage may follow the giving of the vaccine. The possibility has been considered by the responsible authorities in the United States and it has been concluded that it is not an important hazard and may be ignored. In our studies of the autoallergic disease we attempted to produce kidney disease by the inoculation of kidney suspensions into experimental animals but obtained negative results. As far as we are aware such damage has not been produced in this way by anyone else either. We are therefore inclined to agree with the authorities in the United States about the unimportance of this hazard.

The amount of penicillin in the vaccine fluid at the beginning of its preparation is 100 units per ml., a relatively small amount compared with the doses of 1,000,000 units or more commonly used therapeutically. The chances of sensitization are therefore

slight, but it is possible that particularly susceptible children may become sensitized. It is likely that many more children will be sensitized by therapeutic use of penicillin than from receiving poliomyelitis vaccine. Nevertheless in the studies in our laboratories it has been found possible to substitute other antibiotics not commonly given by parenteral injection for the penicillin.

We wish to make it clear that the vaccine at present being issued has not been subjected to these additional measures of purification. The vaccines which will be available next year when the booster doses for the children vaccinated this year will be given will have undergone this treatment. Sensitivity reactions and sensitization at that time, therefore, should be minimal.

There has been some criticism of the fact that no large-scale study of the effect of the South African vaccine has been carried out in South Africa. It has been estimated that to obtain significant results it would be necessary to include in the study as many children as took part in the American trial of 1954. This number is greater than the total number of European children under the age of six in South Africa. An adequate trial is therefore not possible in this country.

However, the findings in the American trial are probably applicable to the vaccine prepared at the Poliomyelitis Research Foundation since they both conform with the same standards. After evaluating the results of this trial Dr. Francis reported that there was a significant difference between the incidence of paralytic poliomyelitis in children who had been vaccinated and the children who had not received the vaccine. It protected about 70% of the children who otherwise would have had a paralytic attack. Although of considerable benefit better results are hoped for from more recently produced vaccines.

Most virus workers will agree that it is probable that a living avirulent virus vaccine will provide better protection than the formalin inactivated type of vaccine. Indeed the team at the South African Institute for Medical Research were among the first to attempt to develop such avirulent strains and to point out the advantages of an orally administered vaccine. This work still continues both here and in other countries. Already such avirulent strains have been developed and experimental studies of their value in stimulating immunity have been undertaken, notably by Dr. Koprowski and Dr. Sabin in the United States.

Dr. Koprowski recently reported on his studies before a meeting of the Southern Transvaal Branch of the South African Medical Association. In these studies he has shown that after oral administration of these viruses the majority of individuals develop antibodies. Up to the present less than 500 individuals have been given these virus strains. Even from this number it may be concluded that these viruses are effective in stimulating immunity. Although none of them have suffered any ill effect and although it may be anticipated with a fair degree of confidence that such feeding will be safe, it will not be known how safe the procedure is until not 500 but 500,000 or even 5,000,000 children have been fed with these viruses.

In time this will be done, but it will probably take several years before their value and safety is clear. During this interval many will want to offer the children in their care the benefit of vaccination with the formalin inactivated type of vaccine which is the only type of vaccine at present available for use. Our aim in preparing a formalin-inactivated vaccine has been to meet this need.

May I continue Dr. Shapiro's quotation?

> '. . . Thus conscience does make cowards of us all;
> And thus the native hue of resolution
> Is sicklied o'er with the pale cast of thought,
> And enterprises of great pith and moment
> With this regard their currents turn awry,
> And lose the name of action . . . '

and then go back to the beginning:

> 'To be, or not to be: that is the question:
> Whether 'tis nobler in the mind to suffer
> The slings and arrows of outrageous fortune,
> Or to take arms against a sea of troubles,
> And by opposing end them? . . . '

James Gear
Director of Research, Poliomyelitis Research Foundation

Hospital Street
Johannesburg
17 September 1955.

THE POLIO VACCINE AFFAIR

To the Editor: The laity and ourselves have been subjected to a voluminous verbal diarrhoea of journalistic jubilation about this polio business. At the same time there has been a marked constipation in our channel of information, happily followed on 3 September (in our *Journal*) by catharsis.

In his broadcast a Minister of the Crown, I consider, was unwise to give his conclusions (though backed by professional authorities) before the general body of medical men had been informed through the Ministry or Medical Association.

In general it appears that the Press has taken too much licence in being given premature copy. Also it would seem that the Minister of Health in his administration has shown lack of wisdom and tact.

I do not presume to debate the technicalities of the pros and cons of the new vaccines. But after careful consideration I must say the 'publicity' of this matter has been handled badly in so far as it affects the laity, who look to their medical advisers for information that is authentic—or do they?

J. Leo Treneman

155, Bellair Road
Mayville
Durban
12 September 1955

FOETAL DISTRESS

To the Editor: With reference to my article under this heading[1] appearing in the *Journal* of 10 September, I wish to draw your attention to the fact that there is a typographical error on p. 858.

Under *Table I*, the figures for (B) (ii) *Postmature cases* should read thus:

19	14 (73·3%)	7	4 (57·1%)	12	**10** (83·3%).

Thank you for a lucid production of the paper.

Louis Resnick

136 Adderley Street
Cape Town
12 September 1955

1. Resnick, L., (1955): S. Afr. Med. J., **29,** 857.

PENICILLIN REACTIONS

To the Editor: After reading about the two cases of penicillin reactions reported in the *Journal*,[1, 2] I wish to add a further case that occurred with me a few days ago.

A Native woman, about 45 years of age, was brought to me by her employer for a septic arthritic condition, for which I gave her 1 c.c. (300,000 units) of Crysticillin. I gave it into the right deltoid muscle. About 2 minutes after injection the patient complained of nausea and began to vomit; then collapsed onto the ground. Her breathing was gasping, she was cyanosed and pulseless, and death seemed imminent. I administered 100 mg. of Anthisan intramuscularily, followed in 30 seconds by 2 c.c. of Coramine intravenously.

About 5 minutes later her breathing became more normal and the cyanosis faded. Twenty minutes later she regained consciousness and left my surgery 1 hour after the injection. For the rest of that day she had a frequent desire to pass urine and also tenesmus; she passed small amounts of pure blood in the stool. I gave her 100-mg. tablets of Anthisan to take 4 hourly.

On questioning her employer, I was told that following a similar penicillin injection about 6 weeks previously she developed nausea and vomiting with a certain amount of circulatory collapse, but no connection between this and the injection was suspected. In neither of these two instances do I think intravenous injection of the penicillin played a part. I feel that it must be classified as another 'penicillin reaction'.

J. L. Beckh

P.O. Creighton
Natal
4 September 1955

1. Smith, J. L. (1955): S. Afr. Med. J., **29,** 772.
2. Botha, J. G. (1955): *Ibid.*, **29,** 780.